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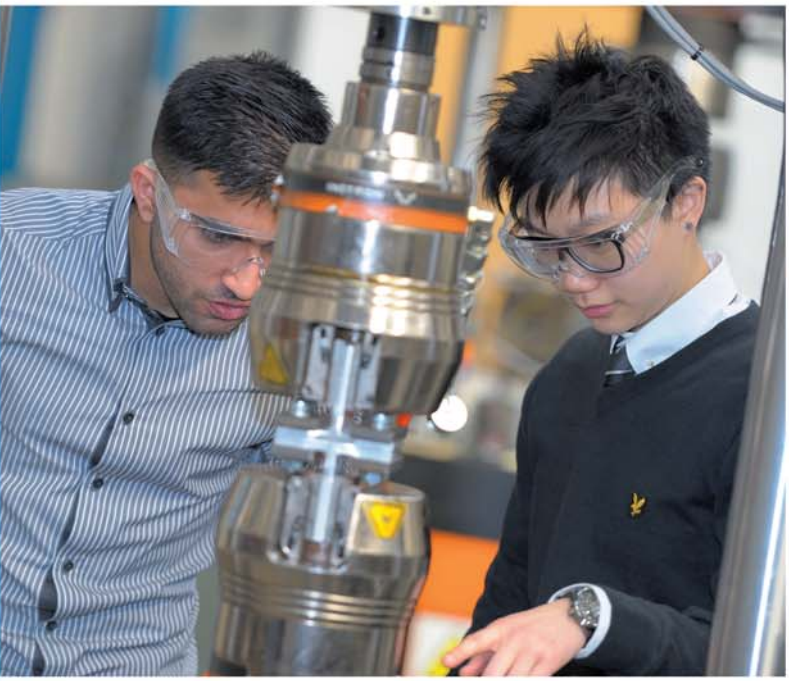

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Andrew Miller MP
Chairman, Parliamentary and Scientific Committee

I am (only) occasionally asked "What is the point of the P&SC?"

First, let us be clear, the P&SC has no political agenda. It exists to promote open discussion and debate between the scientific and political communities, in the expectation that evidence will sometimes (often?) influence policy.

In the spring of 2012, we ran a discussion meeting on HS2. This is still pending, but at least the facts were teased out. It is not the ten minutes reduction in transit time for the suited business community. However the argument for increased capacity of the line to transport people was well put.

Later in 2012, we discussed "Fracking", and were able to hear from Cuadrilla's CEO about the energy stored beneath Lancashire. It is clear from recent polling that the media coverage of the story fails to reflect public opinion even in areas where pilot wells have been drilled.

More recently Monsanto has followed Syngenta's example and withdrawn from the European debate on GM crops. Some campaigners correctly identify this as a major victory. Yet all of them wear clothes made from GM cotton, and this has contributed to a reduction in the death rate (from organophosphate insecticides) of cotton farmers in India and China. All (or most of them) drink cordials sweetened with High Fructose Corn Syrup. 90% of maize is GM. Many of them eat chicken fattened on GM soya. By campaigning to reduce crop yields, they are, perhaps inadvertently, encouraging the destruction of the Amazon forest to grow more soya.

On the matter of the MMR scandal, rejecting scientific evidence has led to only a few dead children from measles, but Swansea had a very narrow escape.

Earlier this year we discussed the issues arising from the absence of new antibiotics, and heard from the CMO (Dame Sally Davies), as well as from industry about the costs of drug development. The public sector clearly has a role to play, and Parliament needs to define this.

More recently commenting on the Duchess of Cambridge's pregnancy, there has been a silly suggestion that pregnant women should not travel in new cars, and resist from the temptation to paint the new baby's room. (The Duchess perhaps more than most, knows the smell of new cars and freshly painted buildings). Such unfounded scare stories need to be stamped on. Fortunately P&SC is not alone, and we should acknowledge the sterling role played by the Science Media Centre and Sense About Science, both of whom have been fearless in debunking rubbish.

Science may not always have the correct answer today. But the alternatives yield nothing but hunger for billions, the lights going out, and people facing unnecessary risk.

SCIENCE IN PARLIAMENT
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The Journal of the Parliamentary and Scientific Committee.
The Committee is an Associate Parliamentary Group of members of both Houses of Parliament and British members of the European Parliament, representatives of scientific and technical institutions, industrial organisations and universities.

The Parliamentary and Scientific Committee

Science in Parliament has two main objectives:
1. to inform the scientific and industrial communities of activities within Parliament of a scientific nature and of the progress of relevant legislation;
2. to keep Members of Parliament abreast of scientific affairs.

CONTENTS

LEADING THE WAY: DIVERSITY AT THE ROYAL SOCIETY

Professor Dame Julia Higgins DBE FRS FREng
Professor of Polymer Science at Imperial College London and chair of the steering group for the Royal Society's diversity project 'Leading the way: increasing diversity in the scientific workforce'.

As Chair of the Royal Society's diversity programme steering group I was delighted to be invited to sit on the panel for Parliamentary Links Day. Parliamentary Links Day is organised by the Society of Biology on behalf of the whole science and engineering community and is supported by a wide range of scientific societies and organisations including the Royal Society. The day was a huge success and brought together policy makers, MPs, ministers and representatives from the STEM community for talks and discussions about diversity in science. Topics covered included the 'leaky pipeline' through academia, social mobility, integrating the sciences in schools, work experience and parental leave.

With the number of women holding professorships in science, technology, engineering, maths and medicine (STEMM) subjects at 15.6% (ECU, 2012), and this pattern mirrored in industry, it is clear that women's recruitment, progression and retention is a major issue in STEMM academia. Andrew Miller, Chair of the Science and Technology Select Committee, announced that an inquiry would be launched to look at women in STEM careers. The committee put out a call for evidence to which the Royal Society responded, using information and data from our diversity programme. We are currently awaiting the outcome.

. . . the 'leaky pipeline' . . .

Diversity in science is wider than just gender. Individuals from lower socio-economic backgrounds, certain ethnic minorities and disabled people are all under-represented in education, training and employment related to STEMM. Lack of diversity across the scientific community represents a large loss of potential talent. Restricted opportunity and diversity limits not only UK competitiveness and prosperity, but also vitality in the wider scientific workforce and creativity in society. The Royal Society is tackling these issues on two fronts, internally through the Society's Equality and Diversity Advisory Network and externally through its diversity programme.

The Royal Society's four-year programme, funded by the Department for Business, Innovation and Skills, complements a programme by the Royal Academy of Engineering. While the two programmes are separate, there are areas of overlap including comprehensive data gathering, pilot activities, and showcasing role models.

. . . a large loss of potential talent . . .

The Royal Society's diversity programme *Leading the way; increasing diversity in the scientific workforce* is investigating ways to remove barriers to entry, retention and progression within the scientific workforce. It focuses on gender, ethnicity, disability and socio-economic status in the first instance and aims to cultivate leadership in the scientific community. We are focused on individuals making career transitions. For the purposes of the project, the 'scientific workforce' is taken to comprise all those for whom their scientific knowledge, training, and skills are necessary for the work that they do.

. . . women's recruitment, progression and retention . . .

The programme covers both academia and industry. The

majority of those in the scientific workforce work in industry particularly in small and medium-sized enterprises (SMEs) (61.8% of scientific workforce work in SMEs). Academia therefore represents only a small fraction of the workforce. However there are many successful schemes and initiatives including the Athena SWAN Charter, which focuses on women in science, which promote good practice in science. We must learn from these to increase diversity in the wider scientific workforce. A recent report from the Women's Business Council made two recommendations that are key to our wider diversity definition: to broaden young people's aspirations and job choices before the start of their working lives by increasing partnership involving schools, business and parents; and for businesses to embrace flexible working and to support working parents.

. . . individuals making career transitions . . .

The programme has several different projects including a data gathering exercise to improve our understanding of the scientific workforce, and to identify where gaps exist. This includes investigating socio-economic status within the scientific workforce, and research into social mobility in the scientific workforce using 1970 British Cohort Study. An analysis of HESA data on staff and students will identify at what point people leave academia, and where they go. We will combine this into a single report to answer questions about what the scientific workforce looks like. This will be published towards the end of this year.

We have commissioned research on establishing the business case for diversity in the scientific workforce. This will consist of a literature review and key interviews looking at the economic case for diversity. It will establish the difference diversity makes to science, looking at optimum group size and diversity in relation to a range of productivity measures.

Another activity under the programme is a collaboration between the Royal Society and 'An Oral History of British Science' led by National Life Stories at the British Library.

. . . promote good practice in science . . .

We are working with National Life Stories on an oral history project focusing in the first instance on scientists from different ethnic groups. The project uses an interview, and will chart the life stories of 10 individuals active in UK science, focusing on the interplay of issues such as universities, learned societies, and ethnic diversity. We will expand this methodology to include gender and disability.

. . . 'An Oral History of British Science' . . .

A pilot project has been established with Equality Challenge Unit and the Athena SWAN Charter to look at the compatibility of the current Athena SWAN framework with the structures and working practices of research institutes, with a view to extending the Charter. This pilot involves BBSRC, MRC, NERC, EPSRC and independent research institutes. It aims to explore research institute management structures, career pathways, and policies and procedures, identifying where the current Athena SWAN framework may need to be adapted.

The Royal Society provides the secretariat for the STEM Disability Committee (STEM-DC). STEM-DC is a group of professional bodies which considers ways to improve policies, practices and provision for disabled people in STEM, including those aspiring to a STEM career as well as those already employed in a STEM role. Projects have included: developing a good practice guide for academic staff on supporting STEM students with dyslexia; the creation of over 100 new physics and engineering British Sign Language (BSL) signs and commissioning a further 200 signs; a project to support assessors who conduct Disabled Students Allowance (DSA) Needs Assessments for STEM students.

. . . career pathways, and policies . . .

. . . developing a good practice guide . . .

We held a very successful Wikipedia 'edit-a-thon' last October focusing on improving the online records of women in science using the Royal Society archives and library followed by a panel session led by Professor Uta Frith FRS on this topic. The Royal Society received a 'Wikimedia UK' award – Educational Institution of the Year – for the 'edit-a-thon' and there have been calls to hold more such events. As part of their Centenary celebrations, the Medical Research Council, in conjunction with the Royal Society, is planning a series of Wikipedia Women in Science "Edit-a-thon" events throughout 2013 that will highlight the wealth of outstanding female scientists over the last century. As well as the edit-a-thon, each event will include a discussion led by leading female academics on the challenges faced by women in science and how we can address gender under-representation. An event was held at the Royal Society on 11 October 2013 in celebration of Ada Lovelace day.

We are building up a body of good practice case studies on issues within recruitment and retention in industrial employment, as well as undertaking research into the different routes available into the life sciences.

I hope that you will all take the opportunity to engage with the programme and ensure its success in increasing the diversity of the scientific workforce.

ASPA 1986: ALLOWING SCIENTISTS TO 'PLAY' WITH ANIMALS SINCE 1986

Ida Barlow

Ida Barlow is one of University College London's amazing "Bright Club". These are working scientists who perform on stage from time to time, describing their work in an amusing (sometimes hilarious) manner. This is a brief abstract from a recent gig.

Have you ever suffered from insomnia? Most of us have experienced The Curse of the 'Ticking Brain', when our thoughts just refuse to shut-up and allow us a bit of shut-eye. We NEED sleep, and yet sometimes our bodies just refuse to let us have it. What's more baffling is that we don't even really know why we need sleep, or, for that matter why we need to spend 1/3 of our lives doing it!

Trying to solve these questions is what's keeping me up at night. I have just embarked on a PhD researching the genes and neural networks that regulate sleep. In zebrafish. This is useful and relevant to you, I promise, and the reason I'm studying sleep in zebrafish is simply because I can manipulate their genetics and watch them sleep. Pretty sure I would be locked up if I tried to do this on humans.

From the start of my PhD, I was eager to get my hands on a project that I could control. However, my dreams and aspirations of becoming a Superstar Scientist with annual publications in Nature and Science was somewhat stalled when my supervisor informed me that I cannot touch a little fishy until I had obtained my Personal Licence for performing research on animals.

The Home Office is very successful at tearing us researchers away from Laboratory benches to ensure that we know how to look after our little creatures correctly. Anyone in the UK carrying out research on protected animals (which means any living vertebrate, other than man) must complete several days of (what may be considered rather dull) training. Two precious days that could be spent collecting valuable data are instead spent in a training room in Bromley. I had always wanted to visit Bromley, and now here I was.

Ideally, the Animal Scientific Procedures Act 1986 (ASPA 1986) is read before attending the course, which is not too much to ask of conscientious and avid readers of academic literature. Wrong. Scientists are not accustomed to reading tediously long and repetitive documents detailing what may be assumed to be common sense. We are neither lawyers nor politicians. We prefer a peer-reviewed original research article with solid experimental evidence, demonstrating unambiguous support of an hypothesis.

Optimistically, the course commences with Schedule 1, which covers how to kill our lovely creatures. Severing all ties between the head, heart, and body is the general gist of it. This does mean learning the best procedure to anaesthetise or concuss your Animal of Choice, and then also ensuring that it is properly dead (definition: the heart no longer beats and the brain no longer works) before carrying out any procedure. Rather ironically, being taught how to kill animals humanely takes precedence over how to care and look after their well-being whilst alive!

We quickly veer away from any practical skills to learning about the bureaucracy of ASPA 1986 and how this applies to Research Institutions. Not one, not two, but three licences are required before any animal can even be considered for use in an experiment. In addition, every single procedure that may be carried out on any animal must be shown to have a qualified purpose (for the sake of Science, of course!), and a Risk Assessment of any physiological or psychological harm that may be caused to any animal must be carried out. Sounds an awful lot like bog-standard Health and Safety regulations, to be honest.

We leave the course with the mantra of the three R's: Replacement, Refinement and Reduction. In practical terms this does mean that we should all strive to minimise the use of animals; techniques that cause pain or suffering should be refined (we want the most reliable results too!); and the number of animals required should be reduced. This is no menial task when trying to retain the high academic standards that our research institutions set.

An Accredited Multiple Choice Test was the last hurdle in obtaining my Personal Licence, and the final reward a certificate confirming that I am a Certified Fish Husband.

For eager young PhD students like me, the Personal Licence training days are the closest thing to corporate hospitality that I may glimpse: Two whole days on an off-site training course, with a free lunch, and a chance at networking with other like-minded researchers around the country!

Meeting of the Parliamentary & Scientific Committee on Tuesday 23rd April

THE UK SCIENCE WORKFORCE

Diana Garnham
Chief Executive,
The Science Council

I am delighted to contribute to your discussions on UK science skills. This is the Science Council's 10th anniversary year and it now has 42 member bodies from across science and its applications, with over 400,000 individual scientist members. We provide three levels of professional registration – Chartered Scientist which started in 2004, and Registered Scientist and Registered Science Technician which were launched last year.

. . . policy issues affecting the science community . . .

The Science Council has three aims: to serve society and the economy by enhancing the professionalism of the scientific workforce and building trust and confidence in science; to provide a voice on policy issues affecting the science community, fostering debate and the exchange of ideas; and to support member bodies to be more effective in meeting the needs of the science community.

In furthering our work with the science workforce, working with our member bodies we have asked a series of questions intended to help understand how to ensure there are sufficient workers with the right skills to drive forward science knowledge and application in an innovative economy.

- Is high quality labour market information and intelligence (LMI) available to inform employers, government, young people, and education providers?
- Which employers are currently driving demand for science skills and how is this changing?
- What do we understand about the current and future science workforce?
- How do people acquire and maintain science skills?
- All forecasts of demands are upwards. How will policies for investment in the UK science base serve to develop the skills as well as knowledge needs of different types of science and different types of scientist?

We found that the labour market intelligence and information we were looking for did not exist – and in particular there was a lack of LMI suitable for young people and education providers on the demand for STEM skills, especially at a regional level. We also found that existing skills data failed to capture what was driving the demand for science graduates in particular, although it was more straightforward to understand employment trends in STEM sectors. There were also inconsistencies to address: for example, several employer-led reports indicated shortages of STEM graduates which seemed incompatible with the headline data telling us that 51% or more of STEM graduates did not enter STEM employment. There were also other claims that an oversupply of STEM graduates meant that many were not entering graduate jobs.

. . . existing skills data failed to capture . . .

I will address a few of these headlines. The first is STEM graduate employment. There are some 195,000 STEM graduates annually in the UK and yet there are reported shortages in every area. What are the reasons for that? Is the UK turning out the right type of STEM graduates for the employers or are some science graduates lacking in the skills needed for science employment? Are the shortages really the result of large numbers of STEM graduates, and in particular engineering graduates, going to highly paid jobs in the City? Is there something unattractive about the STEM employment sectors?

	Scientific Occupation	Finance (i)	Finance (ii)	Teaching	Other
Medicine and Dentistry	95	1	0	0	4
Subjects Allied to Medicine	80	1	1	3	15
Biological Sciences	22	2	3	21	52
Biology	31	0	3	14	49
Sports Science	1	4	2	31	62
Psychology	23	2	5	20	50
Veterinary and Agriculture	28	2	3	8	59
Physical Sciences	30	4	4	14	48
Chemistry	36	5	1	14	44
Physics	44	10	17	18	21
Forensic and Archaeological Science	60	0	0	0	40
Mathematical Sciences	25	20	13	18	24
Computer Sciences	47	4	9	6	34
Engineering and Technology	59	3	3	3	32
Engineering	61	2	3	3	31
Technology	38	6	4	0	52
Architecture, Building and Planning	53	0	1	0	46
STEM	49	4	4	9	34
Non-STEM	5	7	7	18	63
TOTAL	24	5	6	14	51

BIS, 2009 'Increasing the supply of STEM Graduates or reducing the leakage?', HESA Destination of leavers

Do we have sufficient understanding of STEM employment and science occupations? Is there an underlying issue about diversity and progression through to science professions?

I think these data indicate we need to re-think some of those claims.

Taking Sports Science as an example, the data show just 1% of graduates in STEM occupations, with 31% going into teaching. But we know from other research that Sports Science[1] graduates often aim for occupations that are not classified as STEM occupations or classified STEM sectors: for example sports management, sports journalism or the leisure industry.

Just 8% of STEM graduates go into the City or high level financial services (Finance 1 in the chart), and other sectors that are finance or linked to finance such as insurance (Finance 2 in the chart). For engineering the number is 5% total in the combined finance sectors and just 3% in the 'City' category. Some of these jobs will be clearly STEM based roles – systems modelling for example, or risk assessment, actuarial analysis, business analysis, but overall the proportion leaving for finance is not nearly as significant as people suggest and in my view the sector should move on from this myth. It is also worth noting that a significant proportion of STEM graduates go into teaching, particularly psychology, maths and physics but only a very small proportion of engineering graduates (just 3%) and in this study, no Technology graduates.

A BIS research paper, *STEM Graduates in Non-STEM Jobs*[2], found that the majority of final-year students reported that they wanted to pursue a career 'related' to their degree subject but this did not necessarily mean looking at the degree as a vocational route. The choice to seek out a potentially more varied occupation was a positive one and the potential and reputation of graduate schemes as 'more mainstream' was also a factor.

. . . one third of the science workforce who are non-graduates . . .

This study also reported difficulties in defining STEM occupations and STEM employment sectors.

Fig 2 is an illustration of what the 'food sector' might look like:

This illustrates the diversity and range of employers and career options. There will be scientists working at different levels in every part of this environment and it is clear that there will be many occupations to identify. For anyone seeking out careers, this LMI is complex and hard to follow but it also illustrates how an individual's role might evolve as they move around different employment sub-sectors within the food landscape.

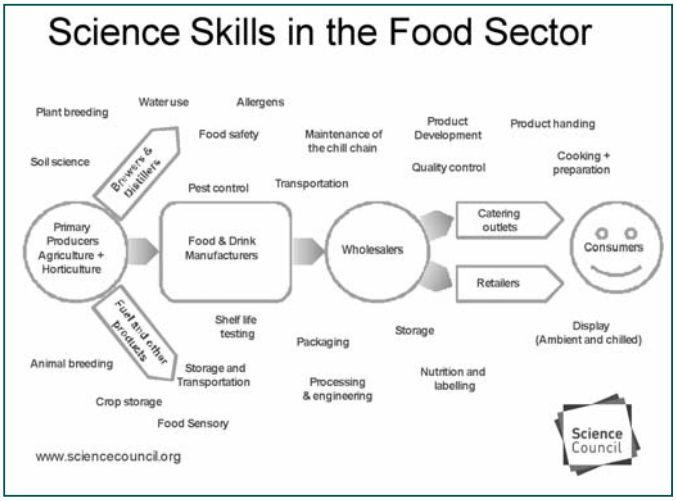

Fig 2

Our next stage was to identify and explore the different types of science related roles. A science professional may have a career as a scientist, in science or from science. Working as a scientist they will be in a STEM environment and the role will be clearly recognised as a science role. Working 'in' science they may be in a STEM sector but will have moved away from direct day to day science and be influencing, supporting, promoting, managing, leading and shaping. Scientists also move into wider employment where their science knowledge and wider skills are also valued and these are 'from' science.

Even within these broad categories the roles differ. To illustrate this I have identified 10 types of scientist.

These are:

1. Explorer
2. Investigator
3. Developer/Translational
4. Service provider/operational
5. Monitor/regulator
6. Entrepreneur
7. Communicator
8. Teacher
9. Business/Marketing
10. Policy maker

The skills required for each of these roles is very different and using this analysis we can see that demand for STEM skills comes from the economy as a whole rather than just the classically understood STEM employment sectors.

In March 2011 the Science Council published its first study of the UK Current and Future

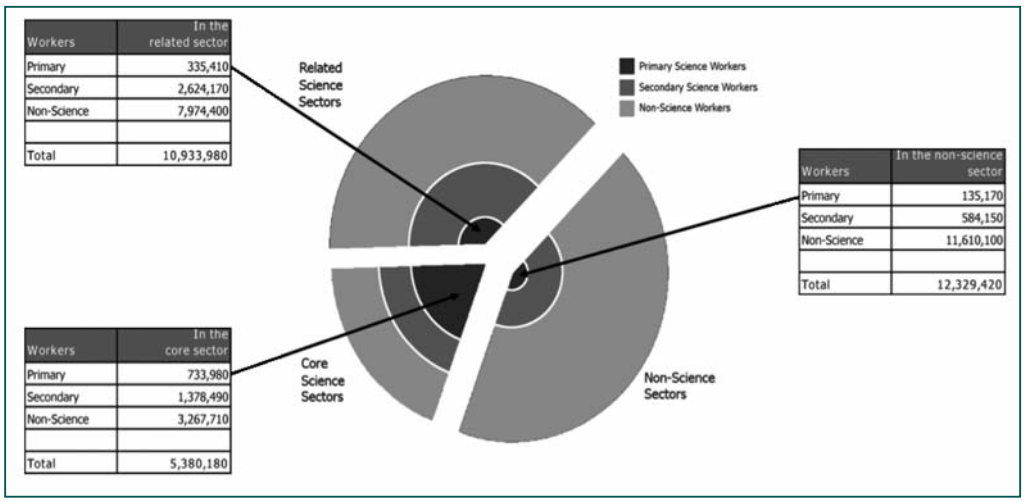

Fig 3

Science Workforce[3]. Building on the understanding we had gained that the science workforce transcends traditional occupation and industry classifications, this study looked at the entire UK workforce. We also wanted to capture the multi-disciplinarity of individuals, employment sectors and new professions and sectors.

. . . science knowledge and wider skills are also valued . . .

Industry/occupation matrices were used to produce definition of employment sectors as core, related and non-science sectors, and workers as primary, secondary and non-science workers, see Fig 3.

This study showed that:

- **20%** of the workforce is employed in science roles, amounting to **5.8 million people** of which **1.2m** were primary science workers and **4.6m** secondary science workers. This is expected to rise to 7.1million in 2030.
- The Health and Education sectors employ 60% of the science workforce and the remaining 40% of the science workforce is distributed across a range of sectors.

The science workforce in academia and research has traditionally been the most visible and vocal, and they feature strongly in both the policy and careers landscapes. However, our data identified this group as under 250,000 (32,000 primary science workers in academia and a further 72,000 in education with 130,000 primary and secondary science workers in R&D) with a relatively high percentage being postgraduates. The more significant finding is the one third of the science workforce who are non-graduates.

Regional science employment distribution is very similar to total economy averages with 37.4% (2.1m) located in the East, the South East and London.

Gender diversity remains an issue in many areas but overall the primary workforce 60/40 male/female similar to UK working population (54/46) with some sectors close to a 50/50 gender distribution. However, there is a higher proportion of females in secondary science roles, particularly in the public sectors and in some science employment sectors, such as ICT, we found extreme gender imbalance with 91% reported as male. Of the 720,000 science workers (primary and secondary) in non-science sectors we also found an extreme gender balance with 73% male, where the profile is for higher pay and older workers.

One of the most important features we identified was that there is a significant number of non-graduates in the science workforce. Using data on the highest qualification the science workforce is shaped as follows: 34% with pre-graduate qualifications, 32% with graduate qualifications and 27% with postgraduate qualifications. The comparison for the whole economy would be 61:15:5. The indications are that the role of graduates and non-graduates in the science workforce will continue to grow.

From the research the Science Council has identified the following policy priorities for the future:

- We need to develop greater diversity in the science workforce;
- There is a need to invest in, develop and support non-graduate pathways into science careers, including provision of apprenticeships, science focused applied and vocational qualifications for post-16;
- There needs to be a review of HE provision to ensure that the STEM degrees meet the needs of both the primary and secondary science workforce;
- The UK needs to address the sharp decline in the number of taught specialist masters degrees available.

REFERENCES

1 BIS Research Paper No 30, *STEM Graduates in Non STEM Jobs*, March 2011

2 BIS Research Paper No 30, *STEM Graduates in Non STEM Jobs*, March 2011

3 http://www.sciencecouncil.org/content/science-workforce

INNOVATION IS GREAT BETWEEN THE UK AND INDIA

Tom Wells, Deputy Head, UK Science & Innovation Network, India

Innovation is an issue of growing importance for bilateral collaboration between the UK and India. This has been the case for a while, but was formalised as a top priority in March 2012 when the Science Ministers of both countries met for the UK-India Science & Innovation Council.

This priority, alongside work to promote UK-India research collaboration, was given the ultimate endorsement at the UK-India Summit in February this year. The British and Indian Prime Ministers issued a declaration in which they "welcomed the rapid expansion of India-UK research and development cooperation, which is helping to generate and develop high quality, high impact

. . . renewed focus by governments . . .

research partnerships leading to new knowledge creation". But they also stated there was "considerable potential for expanding the relationship further" and "encouraged a renewed focus by governments and businesses of both countries … to exploit the potential for cooperation." Since then, a lot has happened to develop UK-India innovation links, with the UK Science & Innovation Network (SIN) right at the heart of the activity. Here's a run through of the latest developments...

During the Summit, the Technology Strategy Board (TSB) and India's Department of Science and Technology (DST) discussed a joint programme to support research collaboration between the UK and Indian businesses. A month later DST and the TSB signed a Programme of Cooperation to set that idea in motion at the evening reception of the Innovate UK conference.

The agreement is the first international partnership the TSB has signed outside of Europe and will see the TSB and the Indian Global Innovation and Technology Alliance (GITA), sponsored by the Indian Government, supporting UK and Indian businesses and academics in joint R&D and innovation projects over a three-year period. The TSB will commit up to £5m to the programme, which will help build and strengthen links between the two countries and build international partnerships between businesses.

With delegates from the TSB in New Delhi in July, the finer details have now been worked out and we're expecting a call for proposals to open in September. To begin with, this is likely to cover clean tech and energy systems, and affordable health technologies. But details will soon be available on the TSB's website, and the call page will be linked to from our blog (see http://bit.ly/15fSlUl).

Since the PM's visit, we've also had some good news for the UK's reputation for innovation. The UK was ranked 3rd in the 2013 Global Innovation Index. Set alongside the fact that the UK has the most efficient research base in the G8 in terms of citations per unit of R&D spend, it was a firm endorsement of the UK as a leading innovation nation.

. . . to make their engines less noisy . . .

In April, the UK's Intellectual Property Office facilitated the creation of a practical toolkit (available at http://bit.ly/1dlODKX) to help academic institutions and business organisations understand how to manage most effectively the intellectual property that arises out of research collaborations between them. Sam Pitroda, Chair of India's National Innovation Council, was in the UK in July. He attended a round table with the who's who of innovation in London, met with Ministers and spoke at an event at Nesta about innovation. Some of the highlights of the event were recorded through the medium of Twitter, see the event page at: http://bit.ly/14Cqrzk.

In July, SIN supported Rolls Royce to launch their open innovation competition in Delhi and Bangalore (see http://bit.ly/1dO5WTM for more details). And we had the FICCI Global R&D Summit in New Delhi where Dr Nick Rousseau, Head – EU & International Policy, Department for Business Innovation & Skills, presented his views on opportunities in International R&D Collaboration. We also had Dr John Clayton, Knowledge Transfer Partnership Advisor from the UK, highlighting the emerging role of SMEs in R&D and innovation (you can watch videos of speakers at the FICCI R&D summit at http://bit.ly/18ZzeLp).

. . . manage the intellectual property . . .

A great example of UK-India partnership translating to innovation is the recent news report on how Imperial College, Indian Institute of Science and Indian Institute of Technology have helped Global engine major Rolls-Royce to develop a low noise technology to make their engines less noisy. You can find out more here: http://bit.ly/19YfDjp.

. . . supporting UK and Indian businesses . . .

The following week, the UK was the country partner for Confederation of Indian Industry's 9th Annual Innovation Summit. The Science & Innovation network sponsored the visit of Mr Richard Cawdell, Healthcare Tech Lead at AcceleratorIndia, to take part in a session on cross border collaboration. It was like a great event, with the UK's innovation capability featuring strongly.

In early September, we had UKTI's Graduate Entrepreneurs Festival (see http://www.entrepreneursfestival.ukti.gov.uk/) in Manchester. And later in the year we'll have the Global Innovation Round Table in November in New Delhi, and the UK innovation and technology showcase. The latter will be in New Delhi and Bangalore, also in November, timed around the 5th Anniversary Celebrations of Research Council's UK opening their office in India. We'll be showing off the best the UK has to offer in innovation – both at the ecosystem level, but also specific world class innovators who may find the perfect partner in India. If you want to know more, please get in touch.

So, in summary, there's a huge amount going on in Innovation between the UK and India. If you want to keep up with the latest news from the Science & Innovation team in India, please visit our blog at http://bit.ly/15fSlUl

. . . the best the UK has to offer . . .

ITALY: THE SEA, THE SUN, THE SAINTS…AND THE SCIENTISTS?

The Science & Innovation Scene – Latest Developments and Opportunities in Italy

Laura Nuccilli
British Embassy, Rome

Alessandra Ferraris
British Consulate General, Milan

BACKGROUND

As everyone knows, Italy is a beautiful country. Over the centuries, some of the most celebrated "brains" of all times were Italians: from da Vinci to Marconi. But over recent years, Italy has lagged behind more advanced European and world competitors in innovation. Longstanding weaknesses such as a lack of strategic forward planning, inefficient use of resources and the resulting brain drain have not helped.

However, even in the current climate of economic constraints, Italy has made significant strides towards improving its R&D sector and has maintained total R&D expenditure as a share of Italy's GDP (from 1.26% in 2009 to 1.25% in 2011, compared to 1.76% in the UK).

R&D INITIATIVES

In 2012, under former Prime Minister Monti and his Research Minister Francesco Profumo, the Italian government focused on implementing a process of fiscal consolidation and reform where innovation plays a crucial role for boosting competitiveness and long-term sustainable growth. Minister Maria Chiara Carrozza, who took over from Profumo in the new government in April 2013, is determined to continue along the same route. In meetings, she has made clear that "resources allocated to science and innovation should not be considered a cost but as an investment for the benefit of society and essential in tackling emerging global challenges".

. . . significant strides towards improving its R&D . . .

The new government's most recent measures concentrate on a mixture of budget cuts and streamlining research funds. The overall framework is still oriented towards direct grants and loans, but there is a move to shift some of this indirect financing towards encouraging demand-driven innovation in key research areas. Focus has been on the decline of ordinary non-competitive funds, a higher degree of integration with European R&D and Horizon 2020 priorities, and a simplification of the funding programmes.

For the first time, an evaluation exercise of Italian universities was carried out by the National Agency for the Evaluation of the University System and Research (ANVUR): ANVUR data will be used by Italy's education and research ministry to award about €540 million (£464.5 million) in 'prize funds', part of the government's 2013 university budget. The ANVUR rankings may also end up playing a part in a continuing debate on the possibility of merging some institutes to save costs.

. . . an investment for the benefit of society . . .

On the public administration side, the recently created Agency for the Digital Agenda (ADA) will manage funds for large R&D projects based on ICT development and implement national digitalisation policies. Locally, regions are increasingly involved in initiatives for promoting innovative business

and fostering private-sector R&D investment. In addition, top-down initiatives such as 'Smart Cities', a major investment programme worth 1 billion Euros (£800 million) launched by the Ministry of Education, Universities and Research (MIUR) in 2012, are encouraging all regions towards smart innovation.

To identify best practice and opportunities for collaboration in solving technological challenges in this area, in February 2014 SIN Italy will organise a mission of UK experts to Italy.

demand-driven innovation. Business R&D investment, which accounts for more than half of the total R&D investments, increased from 0.61% of GDP in 2009 to 0.67% in 2011, still behind the 1.07% of the UK. The reform of company incentives signals a move towards indirect incentives and a focus on SMEs which are at the heart of Italian industry. Despite the relatively low private R&D investment, Italy ranks second in Europe after Germany in terms of innovative SMEs. Together with UKTI, SIN Italy organises

. . . new measures have also been introduced . . .

To strengthen the alliance between different R&D systems, interesting new measures have also been introduced. For example, Minister Carrozza recently created the Challenge Prizes, an initiative modelled on Prime Minister David Cameron's Challenges. The outcomes will be presented at Expo 2015 in Milan and a web portal will be used to catalyse partnerships between companies, charities and universities to develop innovative solutions to issues ranging from cultural heritage conservation to waste management.

INDUSTRIAL R&D

But how is industrial research being tackled today? Current policy mainly increases support for new R&D-oriented companies, large collaborative programmes and, more recently, the UK-Italy Springboard, an entrepreneurial challenge and business development opportunity for Italian high-tech, high growth start-ups. SIN Italy's award, the *GR8 Technologies*

. . . new models of collaboration . . .

Prize, will highlight the most interesting new technologies being developed in Italy in the eight areas crucial to UK growth.

To encourage innovation through new models of collaboration between business and academia, in 2013 MIUR set aside €350M (£300M) for the creation of national thematic clusters in advanced manufacturing, green chemistry, life sciences, intelligent transport systems, agrifood, aerospace, smart communities and intelligent ambient assisted living. SIN is already exploring opportunities for building new links with both the UK Catapults and the Knowledge Transfer Networks in some of the sectors which both countries consider key to the national economy.

. . . many international large-scale infrastructure projects . . .

ITALY AS A PARTNER

Despite the limited financial resources and the scarcity of national coordinated large scale initiatives, Italian researchers have the highest productivity in Europe, and Italy ranks fourth, after UK, Germany and France, in terms of EU funding received.

Italy is also an important partner in many international large-scale infrastructure projects and coordinates the European Multidisciplinary Seafloor and Water Column Observatory and European Plate Observing System.

SIN Italy has identified areas of excellence and coordinated initiatives in many fields, such as a workshop in cultural heritage conservation, which resulted in a Memorandum of Understanding between AHRC and the National Research Council; or in food research, fostering the creation of two large EU projects with Institute of Food Research and the University of Bologna as coordinators.

Besides Smart Cities, this year SIN Italy's focus will be on space, bringing to Harwell the Italian Space Agency and Italian companies to discuss policy and future collaborations.

Things are definitely moving ahead in the right direction and the SIN Italy Team is actively working to showcase the UK approach to innovation, creating useful opportunities for cooperation and exchange, linking up with the Italian Minister and senior officials, and making sure that the right enabling environment for research is created for the next Leonardo da Vinci…

SIN Italy Team is present at the British Embassy in Rome and at the British Consulate General in Milan and fosters strategic collaboration in science and innovation between Italy and the UK in a wide range of sectors. If you would like to know more about how we can help please contact us at

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. . . opportunities for cooperation and exchange . . .

LA MERIDIENNE VERTE – Abroad Thoughts from Home

A light hearted look across the Channel

Those who have spent happy hours cruising the autoroutes of France will have noticed from time to time signs indicating "La Meridienne Verte", and may have wondered what this means. It is the most recent manifestation of the perennial competition between England and France.

In 1660, the Sun King was persuaded to establish an astronomical observatory in Paris, and staff were encouraged to solve the question of how to establish longitude accurately. Such a measurement was vital for the world's shipping, and therefore would afford a nation both a trading and a military advantage.

At almost the same time, Christopher Wren was busy designing the Royal Observatory at Greenwich. It took Britain a few decades (60 years) to persuade the Government to put up the money for a prize (£20,000) to anyone who cracked the longitude problem. Those were the days when Parliament took bold strategic decisions.

A further four decades would pass before John Harrison could claim the prize for designing a clock which would faithfully record Greenwich time almost no matter how far you sailed. This, coupled with solar measurement, allowed a navigator to calculate his longitude. A consequence was the decision to base naval charts on degrees east or west of Greenwich.

It is worth mooting that this little piece of engineering did more to allow Britannia to Rule the Waves for the next century or so than any other invention.

By the late 18th century the scientific and commercial world was abuzz with the desire to formalise measurement and standards. In France at the end of the Revolution, there were more measures of weight than the country produced varieties of cheese.

Wren had suggested that a metre be defined as the length of a pendulum with a half period of one second. This had the disadvantage that since gravity was not constant throughout the globe (it not being a perfect sphere), the period of swing varied.

The French recognised that a definition was needed which transcended national boundaries (and pride). They therefore determined that the circumference of the earth passing through the Paris Observatory was 40 million metres. However it still had to be measured so they sent two intrepid explorers off to triangulate France. Jean-Baptiste Delambre set off from Dunkerque while Pierre Mechain set off from Montjuic in the far south west of France.

They mainly used the tops of church towers for their measurements. After six years of toil. and not a little hazard (the King who had sent them on their way with letters patent and gold Louis's had been guillotined!) they finally met in Rodez in Aveyron. On their return to Paris, all that was required was simple Euclidean geometry and to mark out a straight line one kilometre long on the ground. A metal bar was then struck one metre long and locked away in Paris. The rest of the world was invited to copy it.

Better still the gram was then defined as the weight of one cubic centimetre of water (ie a litre weighs a kg). Once again a lump of metal was produced and locked away in Paris. The rest of the world could reproduce it.

There are three keys to the cellar containing these lumps of platinum/iridium alloy. Twice a year the guardians get together to inspect them. Then they have lunch.

France now had the definition of length and weight, as well as the Paris meridian. This latter was eventually to cause a problem. 75% of the world's charts used Greenwich, and this effectively defined world time.

It was (inevitably) the USA who stepped in to resolve the impasse. By the late 19th century, the railroad enabled its citizens to cross the continent with comparative ease. The problem was that without agreement on time, it was not possible to tell customers when the train would arrive. In fact there were more "time zones" in the country than Wisconsin produced varieties of cheese. Accordingly in 1884, President Arthur convened a meeting in Washington with the aim of defining world time. Greenwich won easily. The French abstained, and for 30 years refused to acknowledge the result. It took a World War finally to persuade them in 1914 to accept the inevitable. Even today my French walking maps sometimes mark both meridians.

Then in 1960 the moving finger of science moved on, and redefined length in terms of a wavelength of light – the emission spectrum of krypton 86. Paris is still hanging on to the kilogram, but it is likely to be refined in the near future.

As thoughts of how to celebrate the Millennium developed, the UK, with startling originality, hit on fireworks. On the suggestion of Paul Chemetov (who is a well known architect and respected landscape designer), France decided to resuscitate the Paris Meridian! On behalf of the nation, President Chirac took this to his bosom. School children throughout the hexagon would plant lots of trees along the line and then have lots of picnics. These would be held on Bastille Day, not on 1st January when everyone else was celebrating. The green meridian would be marked as frequently as possible, even (particularly) when it crossed a motorway. Now you know.

In the interests of fairness, one should point out that the successor to metric units, SI units, have been adopted everywhere except Burma, Liberia and (of course) the United States of America. The United Kingdom (of course) has gone half way and sells milk in litres, but beer in pints. Lord (Geoffrey) Howe has been conducting a one man campaign for two decades to get us to adopt the kilometre.

Vive la différence

Alan Malcolm

HOW DO WE INSPIRE OUR FUTURE SCIENTISTS?

Kirsten Bodley
Chief Executive of STEMNET

Kirsten Bodley, Chief Executive of STEMNET, outlines the results of an independent report into the charity's programmes, measuring their effectiveness in inspiring employers, schools and individuals to develop the next generation of skilled workers.

Encouraging and enabling young people to see the opportunities within a career in STEM is an essential part of supporting the UK economy. Recent research from the Royal Academy of Engineering suggests that the UK needs to increase the number of STEM graduates by as much as 50 per cent to remain competitive globally.

The role of STEMNET

Inspiring young people in STEM subjects is one way of addressing this shortfall, and it is what STEMNET, an independent educational charity, which receives grant funding from government and the Gatsby Charitable Foundation, was set up to do.

We achieve this through working in partnership with government, industry, professional institutions and our UK-wide network of local organisations, skilled in facilitating education and industry links to deliver STEM programmes and support.

STEMNET delivers to schools, pupils and employers through three programmes: our Ambassadors programme, bringing volunteers working in STEM professions in to the classroom to stimulate and enthuse young minds; STEM Clubs programme, supporting teachers in taking pupils beyond the curriculum; and Schools STEM Advisory Network, providing schools with help to deliver exciting STEM lessons and projects.

We have 26,000 STEM Ambassadors with more than 3,000 UK employers supporting the scheme, and in ten years we have undertaken over 100,000 activities to inspire young people. Crucially, these programmes have been proven to work.

STEMNET works in partnership with a number of organisations in the UK, including the British Science Association and the Wellcome Trust, whose complementary work promotes and inspires STEM across the UK and has contributed to the 36 per cent rise in young people taking GCSE science in 2012.

. . . UK-wide network of local organisations . . .

Independent evaluation

To evaluate STEMNET's activities we commissioned the National Foundation for Educational Research (NFER) to evaluate the impact of our programmes.

. . . remain competitive globally . . .

The results were published on 9 October 2013 and launched in the House of Commons. These were very encouraging – showing a positive impact on pupils, teachers and the employers who allow their staff to volunteer.

All schools highly recommend getting involved with STEMNET's programmes and also feel that STEMNET's involvement has been of great benefit. Almost three quarters of schools operating STEM Clubs will continue doing so.

The results also showed a positive impact on individuals. Pupils involved in STEM Clubs who participated in the evaluation perceived an improvement in their achievements, choosing to "agree" or "strongly agree" with the statements: "I am doing well in this subject" and "I have been doing better in this subject since taking part in STEM activities". Pupils' enthusiasm for STEM careers also rose, while teachers find the support they receive from STEMNET invaluable, and report that their links with our programmes have enhanced their understanding of the application of STEM subjects.

Below is an in-depth analysis of the NFER's findings in relation to the three key audiences which STEMNET targets – pupils, teachers and employers.

1. Pupils

The NFER report emphasised that involvement in STEM activities positively affects pupils' attitudes and their own perception of their achievements in, and engagement with STEM subjects. Teachers listed the top impacts on pupils as:

- **Increased awareness of the importance of STEM subjects and real world applications**

Direct interactions with STEM Ambassadors dispel negative

. . . these programmes have been proven to work . . .

stereotypes and perceptions of people working in STEM sectors. Since taking part in STEMNET programmes, pupils know more about why STEM subjects are important for everyday life and their relevance to exciting careers.

Understanding the opportunities to work in exciting jobs motivates pupils to work hard in relevant subjects and ensure they choose an appropriate course of post-16 study. Indeed, pupils reported to the NFER that they feel they know enough about jobs in STEM to make good decisions and know where to get more information on STEM jobs.

. . . increased enthusiasm for STEM subjects . . .

A Year Nine pupil quoted in the NFER report stated that STEM Ambassadors *"…provide such a great opportunity for young people like us, teaching us to be open-minded, when we see something that we might consider doing for the rest of our lives we want to research it more."*

- **Increased knowledge and understanding of STEM concepts or topics which can lead to increased engagement**

Pupils have increased enthusiasm for STEM subjects as a result of their involvement in STEM Clubs, interacting with Ambassadors and other enrichment sessions. They appreciate having time dedicated to exploring and learning through a fun and challenging approach to STEM and also sharing their interest with others.

Nine out of ten teachers said that participating in STEM Clubs has increased pupils' knowledge and understanding of concepts and topics. STEM Clubs are proven to engage pupils, regardless of educational attainment and can introduce new ways for students who struggle with STEM to engage with the subjects, as well as stretching gifted pupils.

2. Teachers

As a result of the funding to support delivery of STEMNET's programmes, teachers gain access to new ideas and resources to support their teaching. Our Ambassadors help to inject new perspective and creativity into science, technology and maths lessons and STEM Clubs provide an opportunity to boost enjoyment and learning outside of the classroom.

The NFER report found that the delivery and impact of STEM activities in schools would have been much more difficult and time-consuming without engagement with STEMNET's programmes. 51 per cent of teachers reported that they had experienced challenges in the wider delivery of STEM activities in their schools. Lack of time was the most widespread challenge faced by these schools. The extra resource of STEM Ambassadors can be a huge help.

. . . to boost enjoyment and learning . . .

The increase in the provision of STEM activities has given STEM an enhanced profile within UK schools. All schools taking part in the NFER research said that they feel that STEMNET's involvement has been of great benefit.

On a personal level, getting involved with STEM Clubs, engaging with STEM Ambassadors and other activities, give teachers continuing professional development (CPD) opportunities. Teachers feel more motivated to teach their STEM subject as a result of their involvement in STEMNET's programmes, as they are inspired by new ideas for activities.

Dan Doleman, a Technical Director at Studioworx, and STEM Ambassador, said, "Visiting schools and finding out the level of competency of young people keeps you in touch as a business with the quality of people you should employ."

The Future

Our activities are designed to bring STEM subjects and careers to life. Through an array of projects limited only by the imagination, STEM Ambassadors and school teachers can use STEMNET's support and resources to find new and exciting ways of enthusing and informing young people.

The report identified the huge demand for STEM Ambassadors to take part in careers fairs and to involve more female STEM Ambassadors in delivery of STEM enrichment and enhancement activities. This is something we currently do well, and will develop through focusing some of our existing work in this area.

. . . dispel negative stereotypes . . .

3. Employers and volunteers

STEMNET's programmes are built on the enthusiasm and dedication of a huge network of individuals and organisations. STEMNET could not succeed without the thousands of volunteers and their employers who pledge their time to support our programmes.

While it is essential to have the skills, passion and expertise of individual volunteers, the support of their employers in allowing staff time to engage with young people is critical. Around 3,000 employers, large and small, are already involved through the STEM Ambassadors Programme, with many more supporting in other ways.

For example, GlaxoSmithKline provided a Careers Fair at one of its sites for 100 local GCSE students giving them a chance to learn about job roles across the business and develop practical skills through hands-on workshops.

A secondary school in Nottingham held a speed-networking session as part of the 'options evening', bringing in volunteers from local businesses as well as 15 STEM Ambassadors. Each student and their parents spent 5 minutes talking to a business person before moving on to the next professional. The evening was exciting and lively, and changed lots of pupils' and families' minds about working in STEM.

The NFER report underlined the impact and effectiveness of STEMNET's work over the last ten years, and we will develop our work to inspire and encourage the next generation of scientists, technicians and engineers. We will continue to respond to feedback from schools and employers and make sure that we meet their requirements and enable teachers and pupils to benefit from involvement in STEM events, locally, regionally and nationally.

For more information about STEMNET and the report from the National Foundation for Educational Research, go to: http://www.STEMNET.org.uk/

UK FOOD ENFORCEMENT WANTS MORE MONEY, BUT DOES IT NEED IT?

Professor Andrea Petróczi and
Professor Declan P Naughton
School of Life Sciences,
Kingston University

G Taylor
Hampshire County Council

EXECUTIVE SUMMARY

A system originally designed to ensure food safety 150 years ago needs revitalising. Food is no longer produced and adulterated locally. A world-wide web of distribution coupled with scientific opportunity to alter what we eat, the way it is produced and the source provides plenty of opportunity to defraud, necessitating improved ways of working.

DISCUSSION

The call for more resources:

Enforcement, like every public service, calls for more resources to increase effectiveness, but in a time of austerity can it justify the additional spend?

A system of charging and competitive tendering and successive efficiency initiatives through the latter part of the last century reduced enforcement's capacity to monitor food composition, a fate avoided by those undertaking microbiological testing. This has led to reduced investment in training and technology. The number of enforcement officers has diminished at what some would describe as an alarming rate since the 1950s.

"In 1959, 150 public analysts worked out of 45 laboratories. In 1997, there were 32 laboratories". (Dr Brian Iddon MP)

In 2000, with the discovery of BSE, a new focus on food safety arrived. Across the EU food enforcement was co-ordinated, remodelled and defined. Organisations were set up and given responsibility for Food, for example risk assessment (EFSA), risk management (DGSANCO) and regulations (FSA).

. . . reduced enforcement's capacity to monitor food composition . . .

Comprehensive spending reviews since 2008 have led to further reductions in expenditure on food enforcement. A 37% fall in spend by UK FSA (FSA consolidated accounts) and a 32% fall in samples submitted to Public Analysts for testing has led to three laboratories closing in 2011, leaving only 18 laboratories in the UK.

. . . no prescriptive levels for sampling . . .

There are no prescriptive levels for sampling in the UK. As a result Local Authorities striving for increasing efficiency or simply lower costs will consider reducing the numbers of samples to as low a level as possible. Currently the UK samples at a rate of 2 samples per 1000 population. In Germany there is a prescribed rate of sampling of 5 samples per 1000 population (German framework of food control).

PERFORMANCE OUTCOMES

Demand for enforcement is increasing. In England, the number of registered food premises, the number requiring interventions and actions all increased in 2010/11, however, the resources available fell (LAEMS 2011). Consumers eat on average one in every six meals outside the home. They demand a more cosmopolitan diet and purchase more "ready meals" for consumption within the home (DEFRA, 2008). This necessitates a world-wide web of food distribution which facilitates non-compliance and fraud. Around 78% of our food in the UK is sourced from within the EU, with the remainder sourced from regions beyond EU regulatory enforcement.

There is no single benchmark to judge the performance of enforcement in regard to food safety. The media and public look for non-conformance by the food industry and use this to judge Government effectiveness. Enforcement uses a system to communicate when a food or feed fails to comply with EU legislation – the Rapid Alert System for Food and Feed

. . . demand a more cosmopolitan diet . . .

. . . an increase of detections . . .

(RASFF). In 2006, 80% of food alerts on the RASFF database related to the 23% of foods sourced outside the EU, showing that the majority of issues now relate to food sourced from outside EU enforcement. The RASFF system is not designed to facilitate comparison of enforcement, but an analysis of the RASFF notifications (RASFF Portal) has led to peer reviewed papers which compare, using the number of detections noted by a Member State (MS). Italy, Germany, UK and Spain lead the way (Petróczi 2010). Since 2004, despite falling sampling numbers, the UK has improved its position in the league table. These data also show a reduction in the numbers of detections of transgression "on the street" and an increase of detections, particularly in Germany and UK in the numbers noted by large food businesses, suggesting an opportunity to work more closely with industry, in particular, as resources are reduced.

. . . Freedom of movement of food . . .

The EU is only as strong as its weakest link. Freedom of movement of food within the EU offers a threat to food security if one MS does not maintain an adequate focus on border enforcement. An analysis of Ports across the EU (Taylor 2013) revealed a 129-fold difference in the effectiveness of enforcement at the ports with the Netherlands and Belgium being gateway ports into the EU. The Annual report of RASFF (RASFF 2012) has revealed that in 2012 there was a fall of 7.8% in the number of notifications. This is the first fall in these numbers, and also in the EU's defence against adulteration. Border Rejection saw numbers fall by 6%. In 2012, for the first time, the UK produced the most RASFF notifications in the EU (15% of the total): 517 original notifications matching Italy. Thus the UK maintains a strong position.

HOW COULD ENFORCEMENT IMPROVE?

Several opportunities exist for improving food enforcement which include:

- Decide the mission:
  Does food enforcement (FSA) want to be seen as responsible for food safety or should it adopt a similar stance to that of the Health and Safety Executive and others. Then publicise a "business-consumer and regulator pact".
- Improve Strategic Leadership:
  The local agenda for food enforcement needs to change. Better centralised strategic coordination is required which sets clear expectations and responsibilities for Local Authority enforcement, perhaps through National Boards like the National Trading Standards Board. Local knowledge is vital to an enforcement service, but given the complexity of food enforcement, the local agenda may be best served through a more regional framework and the technological challenges through coordinated centres of excellence.
- Closer working with industry:
  Share information with industry, particularly the largest organisations that have expertise, resources and technical capabilities.
  Encourage and share innovation: technological and business eg shared services across Government.
- A focus on resilience:
  Future failure is inevitable, if we continue to expect zero risk/failure. Food enforcement will need to identify issues and respond quickly.

. . . improving food enforcement . . .

Develop Earned recognition systems which are thorough and can be used to reduce the needs for enforcement.

- Involvement of the public – the wisdom of the crowd.

  Encourage whistleblowing and provide information for the public to help enforce standards, eg make the Food Hygiene Rating System mandatory.

  Engage with the public to educate, communicate and learn.
- Improve Learning:
  Learn from other organisations outside the food industry, look at audit and counter fraud measures. Separate media and crisis management in the event of a crisis.

. . . Encourage whistleblowing . . .

Learn from major failures: undertake risk and reliability analysis avoiding tick-box ratings which simply restate the previous thoughts – "inflated confidence of man".

Think like a criminal: Consider opportunities to defraud using waste products, eg horsemeat, leather and melamine.

. . . Local knowledge is vital . . .

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BIRAX REGENERATIVE MEDICINE INITIATIVE

Matthew Gould MBE
Her Majesty's Ambassador to Israel

"Science is one of the cornerstones of the UK's partnership with Israel. Through BIRAX, we are supporting world leading scientists and institutions to find treatments for some of the world's most awful diseases"

The Rt Hon William Hague MP, First Secretary of State & Secretary of State for Foreign and Commonwealth Affairs

Britain and Israel are world leaders in science. Both have disproportionate numbers of world-class universities, laboratories and scientists and both win disproportionate numbers of Nobel prizes.

There is huge potential for our scientists to work together for the benefit of both countries, and of humanity. Yet the level of collaboration does not get anywhere close to the potential.

This is why one of the UK's goals in Israel in the last few years has been to put scientific collaboration at the heart of our relationship, and start to fulfil this potential.

Minister of Science (Israel), Yaakov Perry and Foreign Secretary (UK) William Hague. Signature of the Memorandum of Understanding between the UK and Israel on Science. ©Mati Milstein

It was clear from the start that this effort would succeed only on the basis of being driven by the science, not by the politics. To make sure what we did was focused on science, our first step was to launch the UK-Israel Life Sciences Council,

. . . four Nobel prize winners . . .

which brings together 21 scientists, to direct our efforts and help us focus on the most important areas of scientific collaboration. We are privileged to have as Council members four Nobel prize winners, as well as several distinguished Parliamentarians, including Lord Winston, Baroness Greenfield and Lord Patel. The Council meets annually, and is co-chaired by Professor Raymond Dwek, Professor of Glycobiology at Oxford University, and Professor Rivka Carmi, President of Ben Gurion University.

In its first meeting, the Council decided that we should focus on regenerative medicine, as a field in which both Britain and Israel are world leaders, and where we could do extraordinary things together. This is why we launched the BIRAX Regenerative Medicine Initiative two years ago with the Pears Foundation and the British Council. BIRAX was the Britain Israel Academic and Research Exchange Partnership, and we converted it into a £10m fund to power major research projects in regenerative medicine.

We have raised over half our £10m target, from industry, philanthropy and the research councils of both countries. Following a stringent international peer review process run by the British Council, we selected seven proposals out of the fifty we received, and are now funding them – bringing British and

BIRAX grant recipients, Dr Sharona Even-Ram (Hadassah – Hebrew University Medical Centre) and Prof Kevin Shakesheff (University of Nottingham). ©Mati Milstein

Israeli scientists together to find regenerative therapies for some of the world's most awful diseases.

We have invested £2 million into new research in the following areas:

- creating stem cells that are genetically identical to particular patients;
- managing immune responses and transplant rejection;
- developing regenerative therapies for dreadful chronic diseases such as type 1 Diabetes, Parkinson's and Multiple Sclerosis; and

. . . international peer review . . .

While we have so far funded pure research, we hope that future funding will include translation research, so that BIRAX will also be able to contribute to UK economic growth. Regenerative medicine offers huge economic potential – this is why the Minister for Universities and Science, Rt Hon David Willetts MP, included it as one of the "eight great technologies that will propel the UK to future growth".

. . . three more priority areas . . .

- working on the vascular environment needed for successful regeneration therapies and viable organ regeneration.

Our regenerative medicine programme is only the start. There is much more to do to develop the scientific partnership. The first thing that the Foreign Secretary did during his recent visit to Israel was to sign a Memorandum of Understanding on Science between the UK and Israel. This document commits us to five more years of the BIRAX programme including new funding for short study-fellowships for early career researchers in both countries. It also outlines three more priority areas where we want to develop the scientific relationship – nano-technology, water and neuroscience.

The future of scientific collaboration between Britain and Israel is an exciting one. We have ambitious plans, and we know where we want to get to – a partnership so strong that in a few years time it will no longer need to be primed by philanthropic funding.

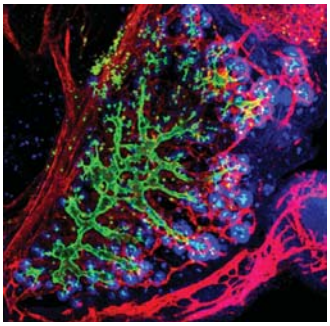
The relationship between our countries is a complicated one. We have real disagreements – for example over settlement building, and the restrictions on Gaza. We are currently doing all we can to support the peace negotiations led by US Secretary of State John Kerry, and have applauded the leadership of both Prime Minister Netanyahu and President Abbas in leading their people into the negotiating room.

But fundamentally, Britain sees Israel as a friend, with shared values and wonderful potential for cooperation. The Foreign Secretary has said that Britain sees Israel as a strategic partner. The Prime Minister has said his faith in Israel is unbreakable. The British Government has taken a clear and firm stand against those calling for boycotts of Israel.

Our partnership in science is a model of what UK/Israel relations can be. It brings together brilliant people and institutions on both sides, who can achieve more working together than they can working apart. In doing so, it benefits both our countries, and holds out hope for the whole world.

The next Call for Research Proposals will be announced at the Second BIRAX Regenerative Medicine Initiative Conference at the Technion Institute of Technology, Haifa, Israel on 25-26 March 2014.

BIRAX Regenerative Medicine Initiative grant recipient, Professor Tamir Ben-Hur (Hadassah – Hebrew University Medical Centre) with Her Majesty's Ambassador to Israel Matthew Gould. ©Mati Milstein



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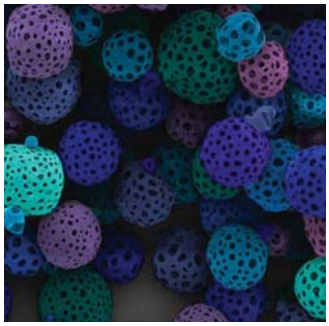


Nano-sized plastic particles ©Prof Kevin Shakesheff's, University of Nottingham

World-leading scientists from Oxford, Cambridge, Edinburgh and Nottingham Universities are working on each of these problems with their counterparts in Israel, through BIRAX.

All this makes the BIRAX programme one of the most ambitious bilateral medical research collaborations anywhere in the world. The scientists and projects funded by BIRAX are at the forefront of Regenerative Medicine; our hope is that the UK/Israel partnership will soon become known as one of the leading international drivers of progress in the field.

Front cover pictures

1 Microscope image – mouse embryo day 6.5 with different protein markers. ©Dr Yaqub Hanna's lab, Weizmann Institute of Science

2 An embryonic pancreas, magnification x 10. ©Prof. Yuval Dor's lab, Hebrew University of Jerusalem

3 Professor the Lord Robert Winston speaking at the UK – Israel Life Sciences Council dinner. ©Mati Milstein

4 BIRAX Regenerative Medicine Initiative grant recipients with British Council Israel Director Alan Gemmell and Her Majesty's Ambassador to the UK Matthew Gould. ©Mati Milstein

5 BIRAX Regenerative Medicine Initiative grant recipients from the UK and Israel. ©Mati Milstein

6 And above extreme left ©Prof. Yuval Dor's lab, Hebrew University of Jerusalem

7 Participants at the first UK – Israel Regenerative Medicine Conference. ©Mati Milstein

8 Professor the Lord Naren Patel, UK – Israel Life Sciences Council member at a BIRAX grant recipients' workshop. ©Mati Milstein

9 Early nerve stem cells grown from human embryonic stem cells. ©Dr. Sharona Even – Ram's lab, Hadassah – Hebrew University Medical Centre

THE VALUE OF DIAGNOSTICS: the role of in vitro diagnostics in tackling antibiotic resistance

Doris-Ann Williams

In vitro diagnostics (IVDs) are an integral part of healthcare for patients. Blood, fluids or tissue are examples of the human samples required to perform such tests. They provide information necessary to complete the clinical picture of what is happening inside a patient. Yet, despite the name, IVDs are not just used to diagnose.

IVDs are used to test the safety of blood supplies by determining the blood group, they are used to screen for infectious agents and rule out possible causes of disease. The role of IVDs in monitoring conditions and treatment is increasingly important. Tests are particularly significant in an acute setting when the results often give a warning to changes in a patient status before physical symptoms appear. Whichever situation they are used in, IVDs support the clinical decision on an appropriate course of action.

Antibiotics have been in routine use for less than seventy five years but modern healthcare has come to depend heavily on them. Bacteria are highly adaptable and many have become resistant to the antibiotics being used. This is

. . . largest single threat to modern healthcare . . .

probably the largest single threat to modern healthcare. Couple this with very few new antibiotic drugs being available and we are in a situation where we could find ourselves without effective antibiotics for treating

. . . high prevalence of pneumococci resistant to penicillin . . .

many conditions in the near future. Hence the role of antibiotic stewardship has come into play to ensure appropriate prescribing. What roles can IVD tests play in tackling antibiotic resistance?

The public need to be aware that simple infections should not automatically mean a prescription from the GP. Many ailments can be overcome by the body's immune system with rest and palliative care. Simple IVDs are also available to determine the cause of common infections such as sore throats and vaginitis; these tools are used effectively outside the UK to support decision making on treatment and helping the patient understand when an antibiotic wouldn't be effective.

When patients are admitted to hospital they are usually subjected to a battery of tests, often including CRP. But there are a number of other tests which specifically help to identify patients at risk of developing sepsis, a life threatening condition also known as blood poisoning which can rapidly overwhelm even apparently healthy adults, often fatally. Serum lactate is one test where

levels provide an early indication of an overwhelming infection if they rise rapidly and the test can also be used to monitor treatment as the level of serum lactate will be seen to fall as the patient recovers. Another test commonly used in managing sepsis is Procalcitonin (PCT).

IVDs can help identify the cause of infection and, if bacterial, can also identify the actual strain of bacteria allowing correct targeting of antibiotic therapy. Using the latest technology the turnaround time is much faster although traditional methods of culture are still in routine use. IVDs have been at the forefront of the fight against hospital acquired infection (HAI) such as MRSA. These are caused by antibiotic resistant bacteria. Perversely, the most highly sensitive tests using a polymerase chain reaction (PCR), have not always been used. This is because they identify too many HAIs in a hospital which means the hospital fails to meet its target for HAI and could result in a fine. This unintended consequence of performance management of healthcare has meant less sensitive testing regimes being used on occasion.

The value of IVDs is not just limited to improving health outcomes and ensuring correct use of antibiotics, although this is the prime focus. But identifying and treating infection quickly and effectively also can lead to significant savings in resource through reduced hospital stays and lower drug costs. As global health costs spiral, all economic efficiencies also need to be exploited and IVDs can play a big part in this.

The BIVDA member companies active in the area of microbiology are embarking on an awareness programme to show the value of the IVDs they produce in targeting antibiotic resistance and supporting antibiotic stewardship. We would be happy to provide more information to anyone interested in this.

Contact: Doris-Ann Williams MBE, Chief Executive on enquiries@bivda.co.uk or telephone 0845 6188224

Case study in primary care: the value of using C-reactive protein (CRP)

The use of CRP testing in Northern Europe and Switzerland to differentiate between bacterial and viral infections in primary care is widespread and this has contributed to a traditionally restricted use of antibiotics and a low rate of antibiotic resistance.

The EU-financed project known as the HAPPY AUDIT took place in the winter of 2008/2009 in Denmark, Sweden, Lithuania, Russia, Spain and Argentina and involved more than 600 GPs to demonstrate whether improvements in the treatment of respiratory tract infections could be implemented via improved diagnostic procedures in primary care.

In the Baltic States, Russia and Southern Europe, where CRP usage is minimal, the prescription rate of antibiotics is much higher with a high prevalence of pneumococci resistant to penicillin as one of the consequences.

Overall, a relative reduction of 25% in the participating doctors' total prescribing of antibiotics was observed. In both acute sinusitis and bronchitis there was a clear association between the level of CRP and the prescribing of antibiotics and where CRP testing was not performed, significant numbers of patients received antibiotics which may not have been necessary. The full findings of the study are available from www.happyaudit.org.

. . . hospital fails to meet its target . . .

The British In Vitro Diagnostics Association (BIVDA), is the national industry body for manufacturers and distributors of IVD products in the UK, representing more than 95% of the industry and over 100 organisations. These range from British start-up companies, often spinouts from Universities, through to UK subsidiaries of multinational corporations. BIVDA members currently employ more than 8,000 people in the UK and have a total industry turnover of just under £1 billion.

DRIVING ENGINEERING EXCELLENCE – the National Structural Integrity Research Centre opens in Cambridge

Christoph Wiesner,
Chief Executive, TWI

Catherine Condie,
PR Manager, TWI

Structural integrity can be seen as the state of resilience and safety of a structure or component in consideration of its material properties, any applied loads, and the presence of flaws or damage.

From an analysis of the numbers of degree-level qualified graduate and postgraduate engineers and materials scientists retiring compared with new entrants to the profession, and the empirical evidence of difficulties in recruitment experienced by both TWI and its industrial partners, there is a need for a greater number of qualified structural integrity specialists than can currently be generated by the Higher Education system[1].

In response to projected trends, TWI instigated, and received funding for, the establishment of the National Structural Integrity Research Centre (NSIRC) to address graduate and postgraduate skills shortages in this area.

The highlights of this initiative are:

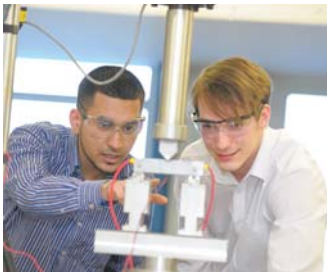
In addition to the reduction of suitable STEM graduates emerging from the education system, it is also reported that they often lack relevant industry experience and are not adequately equipped for the world of work[2]. The challenge is to counter the trend before scarcity of resource and underpinning knowledge affects UK competitiveness, and to boost opportunities for students by giving them access to industry-ready knowledge.

To provide a supply of suitably qualified engineers and scientists in the field of structural integrity, TWI proposed to set up a postgraduate school to train, qualify and award higher degrees and also to develop innovative technologies and approaches to enhance the safety of new and existing engineering structures. The proposal resulted in public funds to support the creation of NSIRC. In parallel, TWI set up the Structural Integrity Research Foundation to channel industrial support to the initiative, matching public funding.

NSIRC's academic supervision and rigour, and the award of degrees, are being made possible through TWI's partnerships with UK universities. Initial partners are Brunel, Cambridge and Manchester universities. The main R&D activities at NSIRC will be carried out at TWI, and the emphasis will be on industry-driven research[3].

Building work on NSIRC facilities has commenced at TWI's headquarters at Granta Park near Cambridge and the first PhD students have enrolled. Masters courses will start in September 2014. The current plan is to develop more than 500 Masters and PhD students in a ten-year programme.

The new £150m postgraduate educational establishment will allow students to achieve qualification as they follow programmes of research directly in line with industry needs. Tailor-made degrees with real project work provided by industry partners will ensure that the next generation of qualified engineers enter the workplace equipped with relevant experience.



The essence of NSIRC is to:

- Develop a critical mass of research informed by the needs of industry, across the field of structural integrity.
- Develop novel postgraduate programmes to train the next generation of researchers and engineers to support UK science and innovation.
- Accelerate the translation of science into commercially relevant products and services.
- Contribute to the development of effective standards and regulations.

POSTGRADUATE PROGRAMMES

By 2015, following completion of a multi-million pound facility at TWI, the educational environment will allow over a ten-year period around 530 students in PhD, MPhil and MSc courses – enabled through the Centre's academic partnerships.

The MSc in Structural Integrity, jointly developed by Brunel University and TWI, focuses on the knowledge and

skills most relevant to developing a career in technical and engineering roles where understanding and achieving structural integrity is a key component. The course will bring together and instil relevant knowledge from the fields of materials evaluation, structural assessment, non-destructive testing (NDT) and failure investigation.

The PhD programme in Structural Integrity will involve in-depth exploration of a research topic. PhDs will be awarded by Brunel University to students who demonstrate knowledge and understanding of structural integrity and who make a distinct and original contribution. The joint PhD programme will combine the application of academic excellence and rigour with a thorough understanding of industrial drivers and context based on the involvement and guidance of the industrial partners including TWI.

The current one-year full-time MSc in Structural Integrity and the three-year full-time PhD are offered in collaboration with Brunel University.

TWI input to the education programme and its day-to-day support to students at NSIRC rest on its established reputation for services in structural integrity technology, built over the last 60 years. Corrosion and structural integrity management have been an integral part of the company's expertise and it has established a world-class reputation for supplying high-calibre design and consultancy services to its member companies in the oil, gas and chemical, construction, power, defence, transportation and other industry sectors.

Corrosion will be a key area of research. As an example, the worldwide cost of corrosion to industry can be estimated at more than two trillion dollars. NSIRC aims to improve

methods used to assess corrosion damage and material deterioration.

The new degree programmes will take advantage of the academic and industry knowledge base at NSIRC to produce high quality engineers with an in-depth knowledge of the science and technology of structural integrity and inspection.

EQUIPMENT

A further value of the NSIRC partnership is that extensive equipment already exists at TWI and within the academic partnership. Grant funding from the RGF and HEFCE includes around £20m for further investment in state-of-the-art equipment. This will ensure that NSIRC has world-leading capability, is best placed to meet its academic teaching commitments and to address the research topics specified by the industrial partners. New equipment includes:

- Reconfigurable, large-scale facilities for specialised component / structure testing systems and software for process simulation, modelling of structural performance and lifetime prediction.
- High-pressure testing equipment for large-scale tests in pipes and vessels.
- Equipment for testing in H_2S, CO_2 and other aggressive environments.
- Remote and intelligent sensors and data analysis tools for condition monitoring applications.
- Selected welding / coating and thermal cycle simulation equipment for characterisation, development and proving of high-integrity fabrication processes.
- Specific / bespoke equipment to address defined areas of research focus of the NSIRC founder sponsors.

BENEFITS TO INDUSTRY

The breadth and scope for industry-relevant coursework to be carried out by postgraduate students is already becoming clear to the NSIRC management body SIRF, the Structural Integrity Research Foundation, and to an increasing number of industry partners. Significant leverage to NSIRC's public funding arises from the involvement and contribution of these partners, and involvement brings an opportunity to influence the direction of practical research into many of the current challenges faced by industry in enhancing material performance, efficiency and cost effectiveness across a range of sectors. This tailored route for critical research allows companies to achieve engineering excellence alongside a new generation of industry specialists.

In summary, NSIRC combines industry-driven academic excellence to address long-term industry R&D needs, with the delivery of additional, appropriately qualified postgraduates and significant economic benefits, both to industry and the UK as a whole.

Find out more at www.nsirc.co.uk or by contacting:

NSIRC, Granta Park, Great Abington, Cambridge CB21 6AL, UK. Tel: +44 (0)1223 899000. E-mail: enquiries@nsirc.co.uk

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3 see http://www.nsirc.co.uk/

CASE STUDY

With the help of a major award from the Government's Regional Growth Fund (RGF) plus a grant for equipment from the Higher Education Funding Council for England (HEFCE) and support from TWI industry contributors, NSIRC opened its doors in May this year to its first PhD student, Anna Voidiwa.

A graduate in engineering with a year's experience in the wood coatings industry, Anna began her studies in the advanced materials laboratories at TWI under the supervision of TWI's advanced coatings expert Alan Taylor. Her three-year structural engineering programme covers research into new coatings and surface treatments to protect low energy surfaces, with a focus on increasing the fuel efficiency and production capacity of large structures including aircraft, wind turbines and ships. These new coatings will be used to counteract the damaging effects of natural erosion, ice build-up or fouling from insects or marine organisms. Anna's degree is sponsored by industry and will be awarded by NSIRC lead academic partner Brunel University.

RESOLVING THE CRISIS OF ANTIBIOTIC RESISTANCE

Professor Laura JV Piddock
Director of Antibiotic Action and BSAC Chair in Public Engagement, Professor of Microbiology and Deputy Director of the Institute of Microbiology and Infection, University of Birmingham

At the June meeting of the Parliamentary and Scientific Committee, co-organised with the British Society for Antimicrobial Chemotherapy initiative (BSAC) Antibiotic Action, there was standing room only with some unable to gain access to the room. The magnitude of the response mirrored the concern of Parliamentarians and Stakeholders about antibiotic resistance and implications for the health of UK citizens.

The introduction of antibiotics in the 1940s led to a revolution in health care, saving millions of lives around the world and facilitated modern day care of cancer patients, organ transplants and commonplace orthopaedic surgery such as knee and hip replacements. However, over the last decade there have been increasing numbers of infections in people by multidrug resistant Gram negative bacteria including *Escherichia coli* and *Klebsiella pneumoniae*. In parallel, there has been a reduction in the number of pharmaceutical companies producing new antibiotics, and the new drugs that have reached the patient have been predominantly those active against Gram positive bacteria such as MRSA. Together antibiotic resistance and lack of new antibiotics presents as serious a crisis to human health globally as the AIDs pandemic did in the 1980s and 1990s.

Antibiotic resistance knows no demographic or geographical boundaries and affects everyone, so raising awareness of the crisis of antibiotic resistance and lack of new antibiotics is extremely important. Dame Sally Davies, the UK Chief Medical Officer, has done much since March 2013 and in her presentation on June 11th she outlined the size of the problem and the societal and financial costs to UK citizens and 'UK plc'. Indeed, antibiotic resistance is of such concern that she has called for the protection and preservation of the few antibiotics effective against bacteria by encouraging appropriate use of these valuable drugs. She also recommended the stimulation of development of new antibacterial treatments and further research to understand and track resistance.

. . . Antibiotic resistance knows no demographic or geographical boundaries . . .

Dr Nicholas Brown, President of BSAC, spoke about the effect that antibiotic resistance has upon the ability of doctors to treat bacterial infections effectively and showed how important antibiotics are to many specialist areas of medicine. He stated that having to use treatments comprising second or third choice antibacterial drugs is much less effective than is the first choice antibiotic for antibiotic-susceptible infections. He also discussed the issues of having to prescribe an antibiotic without knowing the bacterial species causing the infection and the impact of making the wrong choice thereby showing why following the Department of Health's 'Start Smart, then Focus' campaign for antibiotic prescribing is so important.

However, preserving antibiotics is only one part of the solution to antibiotic resistance and as many multidrug resistant infections are by Gram negative bacteria, for which there are few useful drugs, action is required to stimulate the development of new treatments for such infections. Dr Richard Bax, who has a wealth of experience in antibacterial drug development in the pharmaceutical industry shared with the audience some of the reasons why 'big Pharma' have largely withdrawn from this product area. These include the high costs of development and uncertainties over regulatory success and obtaining a product licence. The regulatory requirements have been considered complicated, onerous and expensive and, moreover, difficult to achieve for antibacterial drugs. Current discussions at the European Medicines Agency and the USA Food and Drugs Administration about changes in the clinical trial paradigm will hopefully lead to new and clear guidelines so that the requisite studies to obtain a licence are feasible and not subject to change during the process.

Disussion was lively and covered several topics. It was clear to all that the problems are complex and the solutions are myriad so to do this at a global level requires partnerships between governments and various departments from health, to business, to overseas aid. While incentives to encourage the pharmaceutical industry to

invest in this area are important, without new entities entering the pipeline there will be nothing for Pharma to develop. In January, the World Economic Forum Global Risks Report 2013 indicated the magnitude of that global burden and placed antibiotic resistance on the global risks register. This information was based upon a handful of studies and is considered by all to represent an underestimate of the true burden. There needs to be action by all governments to increase funding for research into antibiotic resistance so that we can fully understand how it occurs, how it is spread and the magnitude of the true cost to Society. This information is essential if antibacterial discovery, research and development is to find and produce new treatments. Academia and SMEs have much to offer in increasing understanding of antibiotic resistance and discovering new molecules and ways to combat bacterial infection. A dedicated funding mechanism for research will not only further the scientific base for understanding the biology of antibiotic resistance and facilitate drug development, but will also stimulate economic development.

As antibiotics are used widely in many settings, discouraging their use other than to treat infection is essential. This includes use where there is no bacterial infection and purchase of antibiotics by the general

. . . There needs to be action by all governments . . .

public, which is widespread in some countries. In addition, new ways to prevent and treat bacterial infections would be welcomed. It should be noted, however, that licensing of any new therapeutic, including phages are subject to the same regulatory processes as antibacterial drugs.

In the UK antibiotic resistance and lack of new treatments is recognised such that the UK has taken a global leadership role. Futhermore, support for addressing the issue crosses all political parties; following the P&SC meeting, on June 12th there was the inaugural meeting of the All Party Parliamentary Group on Antibiotics, chaired by the Shadow Health Minister, Jamie Reed, MP. Kevin Barron MP is Deputy Chair, Zac Goldsmith MP is Treasurer and Baroness Masham is secretary. This APPG will provide cross-party parliamentarians a forum in which they can hear evidence, contribute to debate and identify solutions that the UK can offer to the Grand Challenge of antibiotic resistance and will further support delivery of the 2013 UK five year Antimicrobial Resistance Strategy 2013-2018.

ANTIBIOTICS

Meeting of the Parliamentary and Scientific Committee on Tuesday 11th June

THE SCIENTIFIC CHALLENGE POSED BY ANTIMICROBIAL RESISTANCE

Professor Dame Sally C Davies
Chief Medical Officer

Dr Simon J Howard
Public Health Specialty Registrar

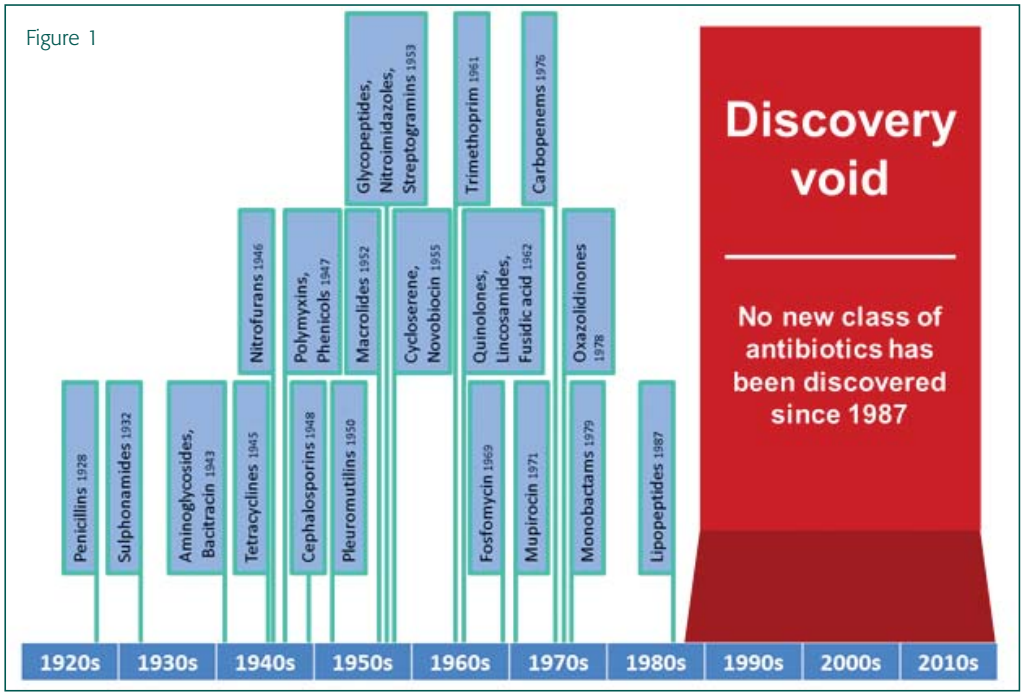
For over 150 years, Chief Medical Officers of the United Kingdom have produced annual reports on the state of the public's health. When I came to produce my annual reports, I chose to break with the precedent set by my recent predecessors and return to the historic format of an annual report in two parts, which I split into separate volumes. The first volume serves a surveillance function, collating and presenting data on the public's health. The second volume provides a detailed examination of a major issue pertaining to public health. The topic examined in detail in my first annual report is infection, including the rise of antimicrobial resistance.

In a break from the approach of my predecessors, I brought together a collaboration of some of the foremost UK experts to advise on the topics which should be covered, and to write the individual chapters. These chapters informed my summary, and the recommendations I made as Chief Medical Officer for England. The result is an authoritative summary of the current situation, which also reflects on the past and scans the future horizon. It includes explicit, actionable recommendations for named organisations, and outlines the scientific challenge posed by infections and antimicrobial resistance.

SCALE OF SOCIETY'S RELIANCE ON ANTIBIOTICS

The size of the threat posed by antimicrobial resistance is underlined by the scale of

Figure 1



society's reliance on antimicrobials. Prior to Alexander Fleming's discovery of penicillin in 1928, infectious diseases were the leading cause of death in the UK, accounting for 43% of all mortality. In less than a century, this has reduced to just 7%. Antibiotic prophylaxis has allowed development of surgical techniques such as hip replacements, which were unimaginable in the early 20th century, but are routine today. Cancer chemotherapy and radiotherapy are also heavily reliant on antibiotic therapy, as is organ transplantation.

GPs in England prescribe 35 million courses of antibiotics a year, though it is notable that there is substantial variation in antibiotic prescribing practice between surgeries, without concomitant variation in patient outcomes.

Yet as antimicrobials have become less effective, the burden of infectious diseases on society has begun to rise once again. The European Centre for Disease Prevention and Control estimates that antimicrobial resistance results each year in 25,000 deaths across Europe each year, which is a similar number to those killed in road accidents.

HISTORY OF ANTIMICROBIAL RESISTANCE

Antimicrobial resistance is not a new problem. Alexander Fleming himself acknowledged the threat of resistance during his acceptance speech for the 1945 Nobel Prize in Physiology or Medicine, which he was awarded for discovering penicillin: "It is not difficult to make microbes resistant to penicillin in the laboratory ... and the same thing has occasionally happened in the body".

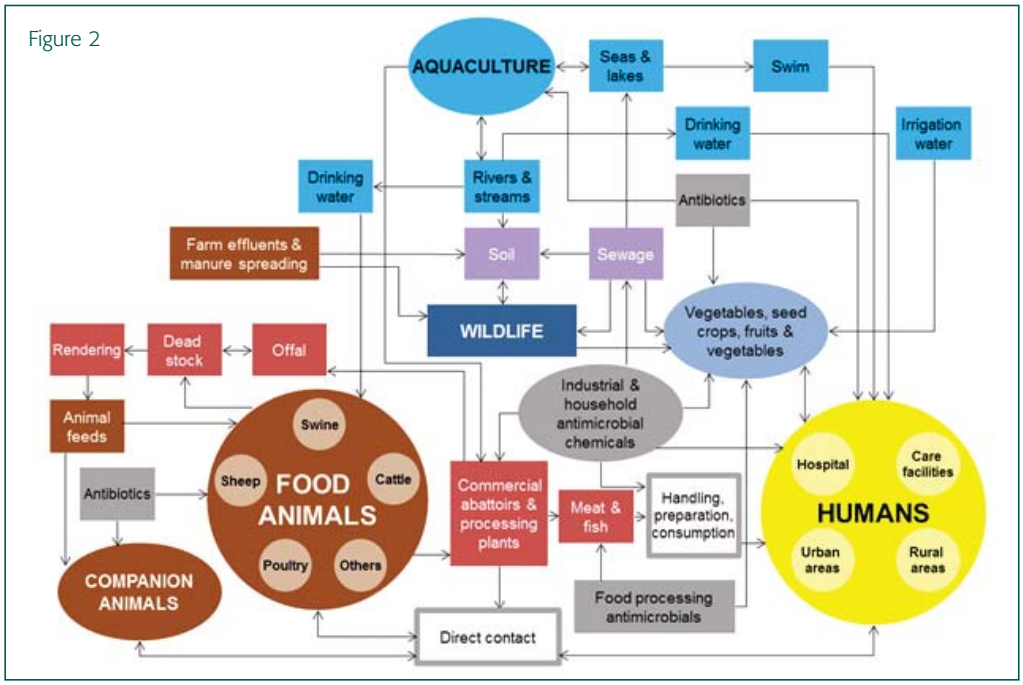
Historically, antimicrobial resistance caused little change in patient outcomes, since doctors were able to respond to bacteria becoming resistant to a particular antibiotic by switching to an antibiotic of a different class with a different mechanism of action. For six decades after Fleming's discovery of penicillin, a steady stream of new classes of antibiotics were discovered (Figure 1). Yet in the late 1980s, the stream ran dry, and no new class of antibiotics has been discovered for over a quarter of a century.

Despite this weakening of the antimicrobial arsenal, society continues to use antibiotics in ways which increase the likelihood of the development of resistant bacteria. Antibiotics are used in agriculture, fish farming, and food production, as well as myriad other areas of life, as shown in Figure 2. Indiscriminate use of antibiotics aid the development of resistant bacteria. Indeed, in Japan and Antarctica, resistant bacteria have now been found in water samples.

CLINICAL IMPACT OF ANTIMICROBIAL RESISTANCE

Antimicrobial resistance is becoming a concern across most branches of clinical practice, but I have chosen to focus on three areas of particular concern in this address: tuberculosis (TB), gonococcal infections, and septicaemia.

Figure 2



Antimicrobial resistance in TB cases is increasingly common. Multidrug-resistant TB (MDR-TB) refers to infections which are resistant to (at least) isoniazid and rifampicin, two of the first-line antibiotics used in TB treatment. In 2011, there were almost 35,000 cases of multidrug resistant TB in Europe, representing a six-fold increase over the number of cases reported six years earlier. 81 of these cases were in the UK.

Extensively drug resistant TB (XDR-TB) infections are also resistant to at least two of the second-line antibiotics used in TB treatment (fluoroquinolone, plus either amikacin, capreomycin, and kanamycin). In 2011, there were six reported XDR-TB cases in the UK.

With increasing resistance, the threat of untreatable TB is becoming a reality. While an international definition of totally drug resistant TB (TDR-TB) has yet to be agreed, there are strains of TB collected from South Africa which were, in lab-based testing, resistant to all standard TB antibiotics.

Gonorrhoea is the second commonest bacterial sexually transmitted infection in the UK. 21,000 cases were diagnosed in 2011, representing a 25% increase on 2010. Yet antimicrobial resistance is making it, too, increasingly difficult to treat. Within the last fifty years, gonorrhea has developed resistance to four different antibiotics. Without a concerted effort on antimicrobial resistance, untreatable cases of gonorrhoea may be seen by 2015.

Similarly, septicaemia is a major cause for concern. More than a third of bloodstream infections in England, Wales and Northern Ireland are now caused by *E. Coli*, and the proportion of *E. Coli* septicaemias which are multidrug resistant has grown to 15%. European data suggest that multidrug-resistant *E. Coli* septicaemias have a mortality rate of 30%, compared with 15% for drug-susceptible cases.

> . . . infectious diseases .. cost the economy £30bn per year . . .

Extrapolating these figures implies that up to 5,000 patients die in the UK each year of a gram-negative sepsis, half with a multidrug-resistant organism. This greatly exceeds the mortality due to MRSA or *C diff.*

ECONOMIC COST OF ANTIMICROBIAL RESISTANCE

In the UK, infectious diseases are estimated to cost the economy £30bn per year. As antimicrobial resistance increases, infectious diseases will have a greater impact on productivity, and this cost will increase substantially. One estimate from the London School of Hygiene and Tropical Medicine estimates that the wider societal costs of antimicrobial resistance in the UK are already around £10bn per year.

In Europe, the World Economic Forum estimates that antimicrobial resistance already costs €1.5bn, and causes 600 million lost days of productivity. In the USA, the direct healthcare costs alone caused by antimicrobial resistance are estimated at $21-34bn.

ACTION REQUIRED TO TACKLE ANTIMICROBIAL RESISTANCE

There are four facets to the action required to tackle antimicrobial resistance.

The currently available antimicrobials must be conserved. They must not be squandered through inappropriate overprescription in humans, nor must they be abused through inappropriate overuse in veterinary medicine, farming or wider industry.

> . . . improve antimicrobial prescribing practice . . .

The development of new antimicrobials must be made economically viable. Currently, the rapid development of resistance and short courses of antibiotics used by patients mean that pharmaceutical companies may not see a return on investment in antimicrobial research. The market has failed to deliver.

> . . . new antimicrobials must be made economically viable . . .

Surveillance of antimicrobial resistance must be improved at an international level. Infectious diseases do not respect international borders. Improving surveillance is crucial to improving preparedness.

Finally, the scientific challenge of antimicrobial resistance must be met. More basic research can improve understanding of the mechanisms of action of antimicrobials, and also of the mechanisms by which resistance develops. Further research into the human health impact of non-human use of antimicrobials is required. Additional clinical research could improve antimicrobial prescribing practice, and aid in the conservation of the current antimicrobial arsenal. Research into rapid diagnostic testing, including DNA techniques, could result in appropriate antibiotics being prescribed sooner, and avoidance of inappropriate prescription.

PREVIOUS SUCCESSES

The challenge of antimicrobial resistance is not insurmountable. The examples of healthcare associated infections show that action delivers results. Cases of MRSA in hospitals in England have declined by 87.3% from their peak in 2003, and *C diff* infections have fallen by over 60% from their peak in 2007.

> . . . concerted effort from governments . . .

However, antimicrobial resistance requires comprehensive action, combining politics, economics and research. It requires a concerted effort from governments around the world, doctors, vets, scientists, and ordinary citizens.

ANTIBIOTICS AND THE CLINICAL IMPACT OF RESISTANCE

Dr Nick Brown
President, British Society for Antimicrobial Chemotherapy (BSAC)

Resistance to antibiotics is a significant issue and a major threat to the world population. Of course, antibiotics are used to treat bacterial infections, but they also underpin much of modern healthcare. They are used to treat traditional infectious diseases, mainly at the extremes of age, and have transformed the impact of these conditions, many of which would previously have been fatal. However, it is not always appreciated that in specialist fields of healthcare, such as organ transplantation, cancer treatments, or joint replacement surgery, infection is one of the most significant complications arising from the treatment. Without antibiotics, these interventions would not be possible. In addition, in some chronic diseases, such as cystic fibrosis, antibiotics have significantly prolonged the life of sufferers.

The emergence and spread of antibiotic resistance in bacteria has been well documented recently. However, it is not new. Even in 1959, data from Seattle, USA were showing extraordinarily high rates of resistance to the antibiotics that were available[1]. In *Staphylococcus aureus*, 40% of isolates were resistant to four or more antibiotics. This was only a decade after antimicrobial drugs first became widely available for clinical use and the medical literature at the time was expressing a general disillusionment with antibiotics and their utility. The difference between then and now, though, is that this was a very productive time for the development of new antibiotics. An agent with high levels of resistance could be replaced by another as new agents came onto the market. There were 14 different classes of antibiotic developed in the period 1935-1968, but only 5 have been developed in the 45 years since.

> . . . resistant to four or more antibiotics . . .

The bacteria causing concern because of antibiotic resistance are different in the community and in acute healthcare settings, although increasingly there is overlap between these. Gonorrhoea and tuberculosis are mainly community infections, whereas many of the organisms that are causing particular concern in hospitals are the Gram-negative bacteria, such as *Escherichia coli, Klebsiella pneumoniae, Acinetobacter baumannii* and *Pseudomonas aeruginosa*. Gram-positive organisms, including methicillin-resistant *S. aureus* (MRSA) caused well publicised problems in both hospitals and the community at the turn of the century. Worldwide, MRSA is still a major concern, but currently it is having less of a clinical impact in the UK. This may reflect the success of the initiatives to control MRSA in this country.

In clinical practice in hospital, antibiotic resistance is important, because it has a direct impact on the outcome of treatment. In a large study in several critical care units in the US, the death rate was proportional to the prevalence of infection[2]. The more infections there were, the more patients died. In addition, if infections could not be treated effectively, mortality was significantly higher than if appropriate antibiotic treatment was given. In a study of over 2,000 patients on a critical care unit, the mortality in patients with infections was 52% if an inappropriate antibiotic was given, whereas it was 12% if patients were given an appropriate antibiotic[3]. The most common reason why the therapy was inappropriate in this study was because the organism was resistant to that antibiotic.

Antibiotic resistance also has important consequences for increased morbidity as well as mortality. Often second line antibiotics are not as effective as first line treatment and therefore the response to treatment is not as good. An example would be the poorer response seen with use of the second line antibiotic vancomycin for the treatment of severe *S. aureus* infection when first line treatment with flucloxacillin, or an appropriate alternative beta-lactam antibiotic, is not possible. Poor response has an impact on the length of hospital stay, use of healthcare resources and overall cost. Using more antibiotic treatment also increases the pressure for the selection of even more antibiotic resistance.

The evidence to correlate these outcome measures and antibiotic resistance has been reviewed recently in a meta-analysis of the published data. This confirmed that the clinical outcome of the treatment of infection due to antibiotic-resistant organisms is worse in critically ill patients, for blood stream infections and, in particular, infections due to Gram-negative organisms with multiple resistance[4].

Why is this such a problem? One of the main reasons is that most antibiotic prescribing is empirical. That is, at the time the prescription is written, the exact cause of the infection is not known. Usually the diagnosis of infection is made on the basis of a clinical assessment and antibiotics are given on a best guess basis. This may be because the currently available diagnostic tests do not give a quick answer, or sometimes, especially in the very young or very elderly, because the clinical

signs of infection might not be obvious.

The consequences are that the wrong antibiotic may be given, or the wrong organism targeted. The Centers for Disease Control and Prevention (CDC) in the US have summarised this (Figure). Antibiotic resistance increases the likelihood of inappropriate initial empirical antibiotic therapy, which results in treatment failure, which leads to more antibiotic usage, which promotes the further emergence of resistance, which leads to more inappropriate therapy.

In practice, this has had some very obvious implications. Over a short period of time, the choice of empirical antibiotic therapy has evolved from one antibiotic to the next to try to keep one step ahead of increasing resistance. Using urinary tract infection as an example, empirical use of amoxicillin, then trimethoprim and then ciprofloxacin has been seen. In some infections, for example gonorrhoea, there are very few or no antibiotic options remaining.

Another very important consideration is the control of the spread of antibiotic resistance. This might be considered as damage limitation, rather than preventing resistance emerging, but does aim to prolong the useful life of the antibiotics we now have. Infection control measures in healthcare settings can prevent the transmission of bacteria from one person to another. Basic precautions, such as hand hygiene, hospital cleanliness, and, in some circumstances, segregation of patients may be used (ie isolation). These measures are effective and were shown to prevent resistant bacteria such as MRSA spreading within a hospital in the 1990s, despite repeated introductions from outside[5]. However, when isolation facilities were swamped, control became much more difficult and the number of infections increased exponentially.

. . . MRSA is still a major concern . . .

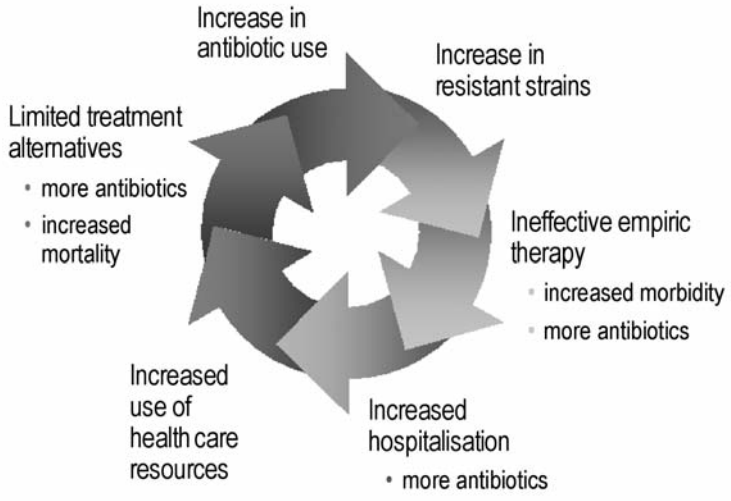
Currently, many hospitals in the UK are being challenged repeatedly by the introduction of multiply-resistant Gram-negative organisms transferred with patients from areas of the world where the prevalence of these organisms is higher than it is in the UK. Two examples are *K. pneumoniae* or *E. coli* carrying *K. pneumoniae* carbapenemase (KPC) enzyme or the New Delhi metalo-beta-lactamase (NDM) enzyme that cause resistance to carbapenem antibiotics, the drug class often thought of as the antibiotics of last resort. The NDM resistance mechanism was described in patients who had come back to the UK from the Indian subcontinent. Many UK hospitals have reported repeated introductions, rather then spread within institutions, although outbreaks have also been described in some settings.

In some parts of Europe, carbapenem resistance is spreading rapidly. Data published by the European surveillance network EARS-NET has shown that Italy and Greece have carbapenem resistance levels of over 50% in some organisms[6]. Transfer of patients from these countries to the UK is not uncommon and it is vital that we learn from our previous experience of MRSA and do not allow repeated introduction to lead to further transmission here.

To summarise, the link between antibiotic use and the emergence of resistance is clear. A new pipeline of antibiotics is needed, not just now, but in the future as antibiotic resistance will always be selected by continuing antibiotic use. We need new antibiotics to improve clinical outcomes in all aspects of healthcare. In order to slow the emergence and spread of resistance, one important challenge is to treat infection appropriately from the outset. This is why current national antibiotic stewardship initiatives, such as the 'start smart then focus', are so important. Development of better diagnostic tests that can influence antibiotic use is important too, and finally we need to think about the repeated introductions of resistant organisms into our hospitals and ensure they are not allowed to spread further.

Figure. Relationship between antibiotic use, resistance, treatment failure and healthcare burden

Source: US Centers for Disease Control and Prevention (CDC)



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ANTIBIOTICS R&D – the current situation and prospects for the future

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He has spent 35 years in all aspects of development and use of antibacterials. Richard Bax is a member of the Antibiotic Action Advisory Board of the British Society of Antimicrobial Chemotherapy.

TranScrip Partners is a global and rapidly growing contract organisation that supports biopharmaceutical product development and life cycle management.

CURRENT SITUATION

Since the mid-1980s few novel compounds with unique modes of action have been registered, while those which have are generally used for Gram-positive infections. The lack of new antibiotics has occurred in parallel with a geometric increase in multidrug resistance (MDR) bacteria especially for Gram negative infections; a phenomenon occurring worldwide and spreading globally. This phenomenon not only significantly affects patients in hospitals but also people in the community. For example *E. coli* urinary tract infections, caused by extended beta-lactamase producing strains also, are resistant to all oral and many injectable antibiotics, resulting in a need for treatment with reserve antibiotics, such as the carbapenems intravenously in hospital [1].

The last truly novel antibiotic with a broad spectrum of activity against Gram negative bacteria was nalidixic Acid, the forerunner of potent fluoroquinolones, launched in 1963. There are several new antibiotics, developed from pre-existing classes, with activity against a narrow spectrum of Gram negative MDR bacteria. Currently, there are few novel broad spectrum anti-Gram negative antibiotics in development. Broad spectrum anti-Gram negative antibiotics in development are in the early stages of development, where risks are high. Therefore there is an urgent need to develop new and relevant antibiotics.

BIG PHARMA RESPONSE

Big Pharmaceutical Companies have largely left the field of antibiotic research, considering both the high cost of development and the low likelihood of clinical and regulatory success [2,3]. Currently the potential market is small and, as the antibiotic would only be indicated for a small number of patients, this results in the company launching into a low generic priced market. However, I predict that some large pharmas will re-enter this area, because, in the future, infections caused by resistant pathogens will increase. In addition, courses of antibiotics are rarely used for more than 14-21 days, which results in a low value proposition for the big pharmaceutical companies. This low potential value, with a high cost of development and low likelihood of regulatory success led to the demise of big pharma involvement. Some research is being carried out in Universities. A small number of small UK companies are in the antibiotic research and development area.

. . . The last truly novel antibiotic . . .

. . . the low likelihood of clinical and regulatory success . . .

PROSPECTS FOR FUNDING

Currently, limited funding is available for interesting science in this area and progression towards a Phase II study. This funding is likely to increase in the future, sourced from organisations such as the Wellcome Trust, and others. In the EU, the FP7 call for proposals ends this year and will be replaced with FP8 calls next year. The European Commission considers antibacterial resistance a priority area and will fund this year's antibiotic related activities, such as R&D, as well as activities which would lead a compound towards Phase II.

The Innovative Medicines Initiative (imi) (http://www.imi.europa.eu/) is a unique European public private partnership between the European Commission and the European Federation of Pharmaceutical Industries and associations (EFPIA). It drives collaboration between all relevant stakeholders including large and small biopharmaceutical companies, regulators academia and patients. It is now on its 9th call with more than €200m in

research initiative to speed up the development of much needed new antimicrobials drugs. The hope is that the IMI initiative will assist in the successful R&D coming to the market within the next 5 years.

GLOBAL REGULATORY ISSUES

Part of the antibiotic paradox is that some companies consider that the unreasonable regulations posed by regulators have led to a decrease in new antibiotic development and hence reduced general availability of much needed new antibiotics. The regulatory requirements for new antibiotics demanded by both the European Medicine Agency (EMA) and the United States Food and Drug Agency (FDA), are so complicated, onerous and expensive that there has been a significant reduction in R&D in this area. This at a time when significant infections, caused by MDR pathogens, are increasing and are difficult to treat with a combination of antibiotics. Of note is that doctors who treat seriously ill patients increasingly find that the pathogen is resistant to all known antibiotics.

There are many suggestions being discussed by academics, clinicians, specialists in infectious diseases, clinical trial experts, statisticians, regulators and others to find an acceptable compromise between evidence development, assessment and access. Members of the Infectious Diseases Society of America[4] made an excellent recommendation for different approaches to the clinical programme, according to the estimated benefit-risk ratio, to the regulators in both the EU and US. This change in the clinical trial paradigm suggests a significant reduction in patient numbers and statistical certainty, as the risk of morbidity and mortality increases in patients with MDR infections. Early market access would be restricted and evidence development would continue, allowing increased but also appropriate use. This approach balances the quantity of data needed for registration with the unmet medical need. These proposals are currently being discussed within the EMA and the FDA administration, and may be the subject of several new guidelines on the registration of antibacterial drugs. It is hoped that this proposal will be considered, allowing the rapid and more certain registration and therefore availability of much needed important antibiotics. The FDA has just issued a draft guidance to the Industry[5] endorsing the approach suggested by amongst others John Rex et al[4] but with important caveats. The next guidance document from the EMA is awaited with interest.

CHANGE AND ACTION NEEDED

Several radical changes need to occur soon, in order to increase activities, and allow for the rapid availability of the appropriate agents. Streamlining of clinical trials has been proposed, with adequate financing and support at all times during the R&D of new and important antibiotics. Too often small companies fail, due to the lack of financial and pharmaceutical expertise in the manufacture of the drug substance under Good Manufacturing Practice (GMP) standards. This is the step before Phase I studies in volunteers.

There needs to be a clear and feasible regulatory strategy agreed with the EMA and FDA in advance of the trial programme, with no unexpected changes. This will lead to a robust Phase II study with the appropriate Pharmacokinetics/Pharmaco-dynamics, and with a high likelihood of regulatory success. Combine this with a compelling value of sales which, due to the limited populations defined in the prescribing information, will result in courses of antibiotics typically given for around 10 days becoming relatively expensive. Together these factors are likely to require significant increases in investment, and consequently lead to early availability for patients.

CONCLUDING REMARKS

With the United Kingdom research groups there are many medical Research Institutes such as the National Cancer Research Institute which in partnership with government, industry, and charities promotes cooperation in cancer research. What is needed to combat the urgent bacterial threat is such an institute or even better a number of these.

Other significant changes must occur within R&D, with Big and Small Pharma, academics and investors all having a crucial part to play and quickly. New funding will help to draw the many stakeholders together, boosting the prospects for meaningful R&D, registration and effective use for patients.

Ultimately, the question is "Can the stakeholders research and develop new and effective antibacterial drugs, and make them available, in time to address the looming bacterial resistance threat?"

ACTION NEEDED

Action	Situation
Clear and feasible regulatory strategy (EU/US)	On-going discussions at many levels with many stakeholders. Gain act LPAD and breakthrough category in place at FDA. EMA in discussion on adaptive designs awaiting publication of guidelines.
Streamlining of clinical trials	In progress at the FDA/EMA.
Secure adequate financing	Pricing issues complex. Interest from some venture capital in the US but not the EU. $1 billion available for bioterrorism from the US government and funding of several large and small US pharmas.
Pricing issues settled to allow investment in R&D	Discussion on-going in the US with companies, purchasers and regulators.

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THE IMPORTANCE OF BEES

Tim Lovett
BBKA Past President and Director of Public Affairs

To members of the British Beekeepers Association (BBKA), whose primary interest is the craft of beekeeping, the honey bee *(Apis mellifera)* is all important, but not to the exclusion of an interest in and understanding of the importance of wild bees and other insect pollinators.

The honey bee is but one of the more than 250 species of bee in this country. Notably, it inhabits the same environment, and experiences essentially the same environmental stresses and challenges, as wild bees, notwithstanding the fact that human intervention in the form of bee husbandry measures such as the provision of hives feeding and disease intervention aids its survival. It thus acts to some extent as a sentinel species; if honey bees are suffering from environmental challenges this may reflect problems for wild bees.

Honey bees are incredibly hard working. It is estimated that to produce a pound of honey worker bees will make around 30,000 foraging flights, each of which may last for up to half an hour. Each kilometre of flight may yield just 0.5mg honey or put another way, each 25g of honey involves the equivalent of flying around the globe. In addition to honey, bees produce wax, propolis, royal jelly and even bee venom is beginning to play a role in medicine. Some 25,000 tonnes of honey are consumed annually in the UK of which only some 20% even in a good year, may be produced locally, the balance being made up by imports.

. . . 25g of honey involves the equivalent of flying around the globe . . .

But even more important than producing these hive products, and honey in particular, is the honey bee's role in pollination. The honey bee has been shown to play a major part in pollinating food plants; up to a third of what we eat is dependent on insect and primarily, bee pollination. Work by ADAS some time ago, clearly established the importance of honey bees in enhancing productivity of key crops such as oil seed rape, field beans and especially soft fruit and top fruits (eg apples and pears), by up to 90% in some cases. The fact that honey bees over-winter in large numbers leaves them well placed to deliver pollination in the early part of the season when wild species are still re-building their numbers. They thus play a significant role in agricultural economics, contributing added value of more than £300 million/a. Their value together with other pollinators in the wild environment is unknown but is clearly substantial in the provision of fruits and seeds on which hosts of birds, mammals and invertebrates depend for survival. There is precious little financial payment for these substantial pollination services.

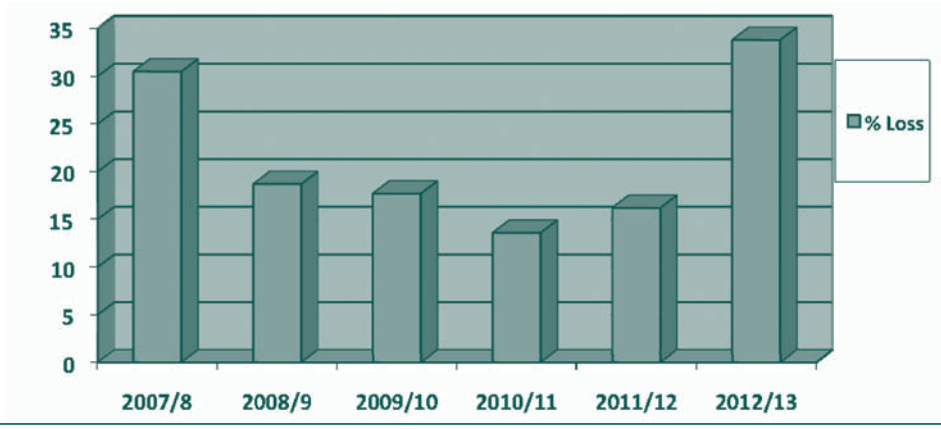
. . . same environmental stresses and challenges, as wild bees . . .

The honey bee faces a complex matrix of challenges which includes pest and diseases, loss of habitat and forage and in recent years, lousy weather! Amongst honey bee pests and diseases is the infamous blood-sucking, Varroa mite, against which there is a paucity of available medications and which spreads viruses in colonies being associated with debilitating disease such as Nosema fungal-type infections. These diseases acting in concert with the appalling, principally wet weather of the last couple of years and poor forage availability, have threatened honey bee numbers in no small way.

The Varroa mite – apicultural enemy number one!)

The BBKA has for years run a randomised survey of over-winter bee colony losses. As the graph here shows, we experienced reduced, though still unacceptably high levels of losses from 30% in the winter of 2007-8 returning however to a new peak of 33.8% last winter.

Over-winter colony losses



These losses are fortunately not cumulative; if they were, we would have lost all our colonies over the last six winters. What it does mean is that our beekeepers have been working exceptionally hard to rebuild stocks, primarily by splitting colonies and building them back up to strength over the season. Splitting and rebuilding colonies means that honey production is reduced; in 2012 it was 70% down compared with the average annual output. Whether the pollination effort available was compromised is unclear but some fruit producers, which are highly dependent on insect pollinators, began to complain of inadequate pollination.

The unexplained, massive colony losses in the USA of up to 80%, reported around 2006 onwards, caused the BBKA to look at its own back-yard. Whilst the so-called Colony Collapse Disorder (CCD) did not appear to be occurring in Britain, losses were still unacceptably high. It became apparent that government was doing far too little in terms of bee health research (just £200K being spent annually by Defra) to ensure that better understanding and appropriate solutions would be found to combat colony losses. The BBKA met resistance from government to confront this issue and following a strong campaign with excellent support from the media, public and MPs, raising over 140,000 signatures on a petition presented to Number 10, some progress was made with the establishment of the Insect Pollinators Initiative (IPI), with £10 million being pumped into nine research projects and further money going into the National Bee Unit. A minority of the IPI projects are of direct benefit to honey bees but it is hoped that data gathered through the programme as a whole will benefit all pollinators, both wild and managed.

> . . . establish a National Pollinator Strategy is welcome. . .

Pesticides and, in particular, the neonicotinoid class have been a focus of attention. Concerns that neonicotinoids cause sub-lethal damage to honey bee colonies have, following extensive lobbying by NGOs, brought political pressure to bear on the EU Commission, which has imposed restrictions on their use for two years starting 2014. The data are inconclusive and considered by many bee scientists as inadequate, yet a ban has been imposed. The principal lacuna in the data is lack of incriminating field rather than laboratory studies. The ban will make gathering this data extremely difficult in future. The BBKA is greatly concerned that older, more damaging pesticides will come back into use to plug the gap left by the neonicotinoids. It demands a comprehensive impact and risk assessment from government of the inevitable changes in agricultural practices which are likely to ensue. It is worth noting that the BBKA's winter loss data-set actually showed a reduction in colony losses over the six year period, (if one ignores the remarkable 2012-13 figures, which are widely attributed to the poor weather, as noted earlier) whilst neonicotinoid use grew strongly. The jury is still out on this potentially damaging factor's true role.

There can be no doubt that there are real problems facing our pollinators. As noted earlier, managed and wild pollinators meet the same or similar environmental challenges. For wild bees it is hard to improve their lot other than to improve habitat and minimise possible damage from stressors such as pesticides. In the case of the honey bee there is at least some comfort that man can intervene in the short term, indeed must do so, to ensure their survival. Steps can be taken to rebuild honey bee colonies, to provide feed in times of shortage and to combat disease. They will also benefit from improvements in habitat and forage availability in the longer run.

Whilst as a result of the BBKA's campaigning more money has gone into bee research it is still frankly inadequate. The research under way through the IPI is pure science, whilst many of the answers and solutions beekeepers need will mainly come from applied research, currently hard to fund. More money must be made available to support this work. The launch of the process to establish a National Pollinator Strategy is welcome and it is to be hoped that actions in terms of land use, habitat improvement, use of pesticides, all on a landscape scale, will be undertaken. There must be greater interaction between government, regulators, farmers and beekeepers. More research funds must be committed and beekeeper training supported to help optimise interventions and avoid decline of bee populations, wild or managed. It is only by positive action that the issues will be confronted and solutions found and implemented to ensure that not only will there be 'honey still for tea' but that all the other yet more important benefits of wild and managed pollinator activity can be ensured and its dependent food production secured.

THE IMPORTANCE OF WILD BEES

Dr Lynn Dicks
NERC Biodiversity and Ecosystem Services Research Fellow, Department of Zoology, University of Cambridge

Bees have been much in the public mind recently. In late August an email was sent to me from a member of the public. This person had found a hundred or so dead or dying bees on the side of the Cambridge guided busway. They were so worried about the bees that they contacted Mike Rands of the Cambridge Conservation Initiative. The dead bees turned out to be workers of several different bumblebee species, and have now been reported to the Wildlife Incident Investigation Scheme as a possible pesticide poisoning incident. This case illustrates how much people care about wild bees.

Why should we care about native wild bees? From a scientific perspective, they are important for two main reasons. Firstly, they are part of our biodiversity. Secondly, they pollinate crops and wildflowers, and this is an economically valuable service. Here I am only going to discuss crop pollination, but pollination of wild flowers is also valuable for aesthetic reasons.

BEES ARE PART OF BIODIVERSITY

There are 256 species of wild bee in the UK. Twenty four are social bumblebees, which form colonies and have sterile workers foraging to feed their brothers and sisters. 232 are solitary species, with no sterile workers and females that each find their own nest and care for their own young. All bees survive entirely on the nectar and pollen from flowers, both as larvae and as adults. They range from tiny black, hairless bees just a few mm long to large queen bumblebees, which can be 2 cm or more long.

The bee world is not straightforward. All around us there are unseen battles going on, mostly about who looks after whose larvae. Fully one quarter of the wild bee species (65 species) are not true bees, but cuckoo bees. They don't feed their own larvae, but lay eggs surreptitiously in the nest of another species. There are cuckoo bumblebees and cuckoo solitary bees. Most true bee species are under attack by one or more cuckoo species.

. . . estimate a value for crop pollination . . .

Beyond bees, many other insects visit flowers for food and can pollinate them. There are 256 British species of hoverfly. These eat only pollen or nectar as adults. Many other flies, wasps, beetles, butterflies and moths visit flowers occasionally for nectar, or to hunt. Unlike bees, all these other flower-visiting insects depend on sources of food other than flowers when they are larvae, including aphids, grass stems or detritus from silt at the bottom of ditches. In the flower-feeders one can find a diverse and intricate ecological system beloved by ecologists for its interesting interactions and its links with many other features of terrestrial ecosystems.

. . . declining numbers of beekeepers . . .

Within the UK, the community of flower feeders is not the same everywhere. A partnership of UK research funders[1] has funded a £9.6 million programme of research called the Insect Pollinators Initiative. One of its nine projects, led by the University of Leeds, has been measuring the flower visitor community in farmland in six regions of the UK, from Somerset to Inverness-shire. Results from the first year's sampling (2012) show a fairly strong difference between north and south, with regions north of a Mersey-Humber line having a higher proportion of hoverflies, and southerly regions a higher proportion of solitary bees.

These data are only from one summer. Ecologists know that flower visitor communities are different not only between places but also between years, especially when one looks at the identities of species. The most abundant species one summer can be very low the following year. The community providing the pollination service to flowers is characterised by what ecologists call 'spatio-temporal variation'.

WILD BEES AS POLLINATORS OF CROPS

The second reason bees and other flower visitors are important: 'Every third mouthful of food relies on pollinators'. This comes from a review by Alexandra Klein and colleagues from the University of Göttingen, in 2007 (Klein *et al.* 2007). They reviewed the scientific and

agronomic literature and gathered studies for all the major global crops where the dependence of yield (fruit or seed production) on visits by pollinators had been measured. The results of this review can be searched, crop by crop, on the International Pollinators Initiative website at: www.internationalpollinatorsinitiative.org/pims.do. When Klein *et al* compiled all this, they found that 35% of global crop production came from crops that depend to *some extent* on pollinators. This is where the 'every third mouthful' statement comes from. Figure 1 shows how the fresh produce aisle of a supermarket looks if you remove all pollinator-dependent products.

The extent of dependence varies. Oilseed rape loses about 25% of oil yield without pollinators. Apples and raspberries lose between 40% and 90%, depending on the variety. Kiwi fruits have separate male and female flowers, and lose over 90% without pollinators.

Knowing the degree of dependence of crops on pollination, and the value of different crops, it is straightforward to estimate a value for crop pollination. This comes out at around £430 million for the UK, using 2007 prices, which was about 8% of the crop market value. Incorporate basic economic theory about the effect of lower supply on prices, and this is about 10% higher.

Not long ago, it was generally believed that honey bees *(Apis mellifera)* provided around 85% of this crop pollination service. Scientific evidence is now emerging from several sources to imply that wild pollinators, particularly the many species of wild bee, are delivering the majority of the service for most crops. One important piece of evidence is an analysis led by Tom Breeze of Reading University (Breeze *et al*, 2011). He estimated how many honey bee hives/ha were required to pollinate fully all the crops needing pollination in the UK, and compared this with the actual density of honey bee hives, to see if there was a shortfall. They found that the lower recommended hive densities for pollination in 2007 produced only 34% of the number of honey bee colonies needed to pollinate the crops. This pollination service capacity of honeybees has fallen from around 70% since 1984, partly due to declining numbers of beekeepers and hives combined with increasing areas of insect-pollinated crops being grown, particularly oilseed rape.

If honey bees only provide 34% of the pollination service, what about the other 66%? As yields of these insect-pollinated crops are rising in the UK, the authors surmise that wild insects must be covering the shortfall.

More evidence to suggest they are correct comes from another of the Insect Pollinators Initiative projects. The Sustainable Crop Pollination project, also led by the University of Leeds, started out by measuring the insect visitors to crop plants. Data from 2011 and 2012 show that honey bees are not the most abundant visitors to field bean, apple or oilseed rape flowers, and make up only 52% of the visits to strawberry flowers. For field bean flowers, 88% of visitors are bumblebees, whereas apple flowers are mostly visited by solitary bees (32%). Measuring flower visits does not demonstrate pollination. The abundance of visits is one element of pollinator effectiveness. Experimental data on the effectiveness of different pollinators at stimulating fruit set can be expected soon.

Earlier this year, an analysis of data from 41 crop systems across the world was published (Garibaldi *et al.* 2013). Each of the studies measured numbers of wild insects and honey bees visiting crop flowers, and also measured fruit set, in at least three different fields. There was good correlation between wild insect visitor numbers and fruit set in all the systems where wild visitors were present. The more insects counted, the more fruit was set. In most cases, there was not the same correlation for honey bees. The number of honey bee visits was unrelated to fruit set.

Taken together, these strands of evidence point towards wild insect visitors, particularly bumblebees and solitary bees, being important in providing the pollination service that is worth £100ms to the UK economy. Since we know this is a diverse group, with different species being important in different years and different places, the **diversity** of wild bees, rather than just their numbers, is important to the pollination service.

Figure 1 Whole Foods Market University Heights' produce department with and without items dependent on pollinator populations.
(PRNewsFoto/Whole Foods Market)

Footnote

1 Natural Environment Research Council (NERC), Biotechnology and Biological Sciences Research Council (BBSRC), Defra, The Wellcome Trust and the Scottish Government.

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BEE AND POLLINATOR DECLINE IS A COMPLEX ISSUE

Mr Don Pendergrast
National Farmers Union

There is a consensus in the scientific community that the decline in bee and pollinator populations is not down to one single cause. In 2010 the UN Environmental Programme published a report outlining around 13 factors impacting on the health of bees and other pollinators. However reports in the media continue to paint straightforward links between presence of pesticides and harm to bees and other wildlife.

The danger of this oversimplification of a complex issue, which fails to take a robust scientific and evidence-based approach to improving bee health, is that at best we risk taking actions that do nothing to improve bee populations but increase the cost of producing food. At worst, this simplistic approach risks taking actions that make the situation worse for bees or have other damaging consequences for the environment.

POSITIVE NEWS

A recent report from a group of well-respected scientists from Europe and the US, including top UK researchers from Reading and Leeds Universities, from Butterfly Conservation and the Natural History Museum (Carvalheiro *et al*, 2013) showed that:

- In Britain and other European countries the dramatic declines in biodiversity happened between the 1950s and 1980s.
- In Britain, declines in bumble bee biodiversity have slowed since 1990.
- The biodiversity of solitary bees has in some cases increased significantly in recent decades.

This is important and it calls into question the over-simplistic coverage of pollinator decline that has dominated recent discussions.

The authors suggest that the slowing and reversal of biodiversity losses has happened since 1990 because of conservation work and agri-environment programmes. Industry led initiatives such as the Campaign for the Farmed Environment have played an important part in promoting land management options to provide food and habitat for bees and in England there are now over 150,000ha of buffer strips, pollen and nectar mixtures, wild bird seed mixtures, hay meadows and wildflowers areas under agri-environment schemes – all measures that will benefit pollinators.

In addition, pesticide best practice has been widely encouraged in the agricultural industry for over a decade via schemes such as the Voluntary Initiative, which deliver training to spray operators and farmers as well as providing an annual test of the equipment used to apply pesticides. A range of other specific stewardship schemes also exist to mitigate specific risks to the environment.

. . . best practice has been widely encouraged . . .

The Defra announcement in July 2013 of a comprehensive review to understand better the factors that harm pollinators, as part of a National Pollinator Strategy, should help to develop existing opportunities further and create a more evidence-based approach to tackling the challenges facing all insect pollinators.

FARMING INDUSTRY SOLUTIONS

Whatever strategy is implemented, it is likely to be the farming industry that offers many of the practical solutions to improve bee and pollinator health. Therefore it is important that farmers are included in this process and incentivised to do more. However poorly-evidenced decisions, such as the one by the European Commission to impose restrictions on the use of neonicotinoids, risk alienating farmers. It does not help to engage farmers when policy and regulatory decisions are made based on limited evidence rather than field studies, particularly when these decisions directly affect a farmer's ability to control pests and produce reliable and affordable supplies of food and other crops.

Only profitable farming and growing businesses will be in a position to deliver solutions to improving bee and pollinator health. If farming profitability is

marginal, farmers won't be in a position where they are able to dedicate time and resources to supporting pollinator services. Balanced policy making is critical to ensuring both environmental and economic sustainability is achieved. This must be based on a balanced consideration of all the evidence, and a holistic approach to addressing sustainable production that focuses on growing more while impacting less.

THE IMPORTANCE OF PESTICIDES

Pesticides deliver a critical service to society as a whole. The benefits they bring to farmer's businesses are just the start to the more significant benefits they bring to an entire supply chain, which provides reliable and affordable supplies of food and other products to consumers.

Pesticides are not cheap, but they are a known technology and farms are equipped to use the technology efficiently and effectively. Crop production is extremely susceptible to variation in weather, which in turn affects the seasonal risk from pests. As a result, technologies that protect the potential yield and give resilience in production are essential for farmers to build sustainable long-term business. Pesticide technology also helps ensure food prices remain under control and as such deliver a critical service to society.

In addition pesticides also

- Reduce wastage of other valuable inputs such as fertiliser, which could otherwise be taken-up by weeds with no environmental or economic benefit.
- Help to facilitate minimum tillage strategies in a timely and economically viable way, thereby reducing carbon emissions, nutrient loss and soil erosion.
- Improved food safety by reducing the presence of harmful contaminants such as ergot and myco-toxins.

Modern crop protection products have been developed to target delivery of the pesticide, minimising the impact on non-target habitats. Seed treatments have been seen as an important step forward in this process, reducing the overall environmental loading by replacing broad-spectrum insecticide sprays. This can be seen in the Food and Environment Research Agency pesticide use survey covering the period from 1990 to 2011 which show pesticide usage has fallen from more than 34m kg to less than 17m kg.

. . . reducing the presence of harmful contaminants . . .

CASE STUDY: NEONICOTINOID RESTRICTION

Oilseed rape is the major UK crop affected by the restriction on neonicotinoids. The primary use of these insecticides is as a seed dressing on winter and spring oilseed rape to protect the crop during early growth (first 6-8 weeks) from cabbage stem flea beetle and flea beetle. Treatments at this stage also control peach-potato aphid, which transmits turnip yellows virus. In 2011, 71% of oilseed rape seed sown in the UK was treated with neonicotinoids (HGCA, 2013). Estimates suggest that the neonicotinoid restrictions could result in a national 10% yield loss (220,000 tonnes) worth around £72million (HGCA, 2013).

In addition to the direct yield losses, the early season sprays (eg 2 to 3 sprays of pyrethroids) would add a further £4.8-7million (HGCA, 2013) cost to production. The absence of other technologies means that increased pesticide resistance in aphids and flea beetles would be a possibility.

This places increased pressure on farming rotation, particularly when you consider that flea beetles and aphids are not just pests of oilseed rape, but also of other major field crops such as cereals, leafy vegetables and potatoes.

SUMMARY

The European Commission's simplistic and overly precautionary approach to restricting pesticide use does not fit well with the fact that bee and pollinator health is a complex multifactorial problem. It has certainly not reconciled the fact that use of neonicotinoids increased during a period when declines in pollinator biodiversity have slowed down or even reversed in NW Europe.

With regards to crop protection, farmers are asking 'where do we go from here?' Will there be other restrictions on crop protection products made on a similar precautionary basis? This would limit evaluations to perceived risks. It would fail to take account of field studies and would not meet the procedures agreed by Member States. Farmers are also concerned that the impacts of pesticide registration changes are not properly assessed in terms of taking into account the future availability of alternative products, the risks of resistance, unintended environmental impacts and the economic sustainability of production.

With regards to pollinators, we need to recognise that farmers and growers already offer, and can offer more, solutions to improve pollinator health. Policy decisions must balance economic and environmental sustainability if they are to be successful. Carvalheiro *et al* (2013) raise the following fundamental questions, which need to be answered by policymakers, and all others involved in pollinator health.

- Which pollinator services are we trying to protect? Do we want to protect common species of bees and pollinators which are doing OK, or rare species which are not doing well? Do we focus our efforts on protecting those species that contribute most to pollination services?
- What is our ambition? Should we focus on slowing and halting declines? Do we need to reverse the declines? If so, reverse them to what point (eg population levels in 1970, or 1950)?

Future actions taken to achieve this aim have to be based on all the evidence. Finally, determining the success of these actions on populations over time will require the evaluation of long-term trends, and effective future monitoring of insect pollinator populations.

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PARLIAMENTARY LINKS DAY 2013
Science and Diversity

The Attlee Suite was filled to capacity – standing room only from the start – for this year's Parliamentary Links Day on 25 June on the timely theme of Science and Diversity. Early tweets spoke of "a huge turnout" and "biggest science event in Parliament!" For connoisseurs of Twitter the event was trending by the end of the morning session!

The Speaker, the Rt John John Bercow MP, opened the proceedings and referred to the proactive work the House of Commons is now doing to promote diversity within its workforce, a point later emphasised by the Head of Diversity and Inclusion, Anne Foster.

Parliamentary Links Day remains the largest single science event on the annual Parliamentary calendar, and was again sponsored on a tripartite basis by Andrew Miller MP, Stephen Metcalfe MP and Dr Julian Huppert MP.

Organised by the Society of Biology on behalf of the science and engineering community, Links Day promotes links and understanding between the worlds of Science, Parliament and Government.

> *"Parliamentary Links Day continues to make a real and worthwhile contribution to the understanding of Members of science and engineering issues."*
> Mr Speaker Bercow

This year's format included a mixture of keynote speeches and panel discussions.

Keynote addresses from Rt Hon David Willetts MP, the Minister for Universities and Science, and Shabana Mahmood MP, the Shadow Minister, discussed the role of education in influencing diversity in STEM subjects while Andrew Miller MP announced a new initiative by the Select Committee on women in STEM careers.

Stephen Metcalfe MP and Dr Julian Huppert MP then chaired the two panel sessions which explored the themes of diversity in science (and ways in which this could be improved) and science's contribution in enabling diversity. The panel members involved a wide range of people with considerable experience of diversity issues from biology, physics, engineering, maths and chemistry.

In a video message at the start the Co-Chair of the Prime Minister's Council on Science and Technology, Dame Nancy Rothwell, stated that Diversity is important "not just because it's the right thing to do but because we can't afford to lose talent". Moreover it wasn't just about women in science, but also embraced ethnicity, sexuality and disability.

Professor Alice Brown of the Royal Society of Edinburgh promoted a holistic approach. She believes that diversity in science is an issue for universities, learned societies and research councils, as well as for the Government. An all-women panel then discussed the roles of education (through schools, universities and the

media), employers, and the government.

Speaker after speaker emphasised the importance of promoting diversity in science by allowing equal opportunities regardless of gender, race, sexuality or disability. The topic of women in science was high on the day's agenda as STEM subjects are highly affected by the "leaky pipeline", a metaphor which describes the decreasing number of women at progressive career stages. Some of the evidence was stark. For example, Dr Cathy Hobbs, from the Council for Mathematical Sciences, said that while 40% maths undergraduates are women only 6% of maths professors are women, and only 10% of pharmacology professors are women. Meanwhile the UK has the lowest % of female professional engineers in Europe and only 4% of engineering apprenticeships in the UK are women.

Dr Heather Williams, Director of ScienceGrrl (a campaigning organisation formed relatively recently) discussed the importance of role models for developing an interest in science – in particular, the importance of good relationships between teachers and students. The STEM Ambassador scheme brought people with a passion for STEM subjects to schools, helping to inspire young people and show them what it's like to be a professional in a STEM subject. The scheme has over 20,000 voluntary Ambassadors across the UK and it was encouraging that 40% are female.

Several argued that there is a vital role for the media in influencing career choice and that more role models were needed, such as female scientists on TV, with scientists breaking the "lab coat" stereotype, could help enthuse young people about the prospect of a scientific career. Among the positive suggestions made was one by Shabana Mahmood MP, Shadow Science Minister, which was the proposal to make gender equity a criterion for the OFSTED monitoring of schools.

Employers could help promote diversity in science in several ways. Work experience was vital for helping young people investigate career options, so increasing the provision of good quality work experience could make a big difference to young people considering science as a career.

"…. Events like yours are important and provide an opportunity to hear new ideas about how best to approach the challenges we face.
The Deputy Prime Minister

"I would like to congratulate the Society of Biology for its vision in organising this event…"
The Prime Minister

"That this House…. welcomes the Society's commitment to serve the public interest by improving the access of all hon. Members to scientific information and a better understanding of science;"

Early Day Motion

Various people agreed that women might feel more encouraged to stay in science if it were easier to have a scientific career whilst raising children. Employers could advocate shared parental leave and provide subsidised good-quality childcare, to help parents raise a family without sacrificing career goals.

Professor Amrita Ahluwalia, of the British Pharmacological Society, suggested the use of quotas to help employers address diversity issues in science. This engendered opposition from Roma Agrawal, of the engineering company WSP. She believed that quotas undermined merit-based recruitment and advocated instead the mentoring of young people through university and job applications, and working to change the stereotypes that surround STEM subjects.

Stephen Metcalfe MP, in concluding the first panel discussion, said that encouraging diversity in science is "not just the right thing to do, but the essential thing to do" while Dr Julian Huppert MP reminded everyone that all three major political parties cared about science and there was a common commitment to investigate the issues involved in making diversity in science a reality.

Andrew Miller MP used the occasion of Links Day to announce on behalf of the Science & Technology Select Committee the launch of the new "Women in STEM Careers" inquiry aiming to investigate the "leaky pipeline" (http://parliament.uk/science). He encouraged everyone present to contribute with written evidence.

Speaking on behalf of the Government and winding up the morning session, the Rt Hon David Willetts MP suggested that forcing young people to specialise early (at the age of 16, when choosing subjects for post-GCSE study) contributes to the "leaky pipeline".

He advocated a European-style baccalaureate system in which the breadth of the curriculum was maintained until the age of 18. However, the current university environment requires a high degree of subject-specific knowledge gained through A-level study, so making changes in the school learning system would require an overhaul of university-level teaching.

"We want the scientific community, just like government, to look like the country it represents", he said and believed that a diverse group of people is often best for tackling problems.

At the Links Day Luncheon, hosted by the Earl of Selborne in the absence of Lord Willis of Knaresborough, the space scientist Dr Maggie Aderin-Pocock spoke passionately about the need for diversity in science and drew upon her own career in an inspirational way.

The hundreds of people attending were provided with a detailed briefing pack. The Prime Minister, Deputy Prime Minister and Leader of the Opposition all paid their own tributes to the work of the Society of Biology in organising Links Day and praised the scientific community. The event also drew cross-party support from all sides of the House in EDM 278.

"I congratulate the Society of Biology on its continuing efforts to bring science into Parliament."

The Leader of the Opposition

Valuable discussions on #diversityinSTEM at Parliamentary Links Day with especially strong contribution from @RomaTheEngineer
Tweet from Peter Luff MP

It's great to see #diversityinSTEM trending - it shows the widespread commitment to tackling #diversity challenges
Tweet from the Society of Biology

#diversityinSTEM is trending worldwide today. Well good afternoon to you too twitter. :)
Audience Member

Buzzing from an amazing day at Parliament. Brilliant speakers, motivated individuals + societies makes me v optimistic. #diversityinSTEM
Tweet from Roma Agrawal

Lack of Women is more prominent in engineering than Science @RomaTheEngineer #diversityinSTEM @RAEngNews

Now watching a video from Dame Nancy Rothwell highlighting that #diversityinSTEM is not just about women but ethnicity, disability etc

We need a stronger, more diverse economy, and we're going to need skills to achieve that says @shabanamahmood #diversityinSTEM

You can access the full Twitter *Storify* at http://storify.com/Society_Biology/links-day

SCIENCE AND THE ASSEMBLY 2013

Leigh Jeffes
Royal Society of Chemistry
Government Affairs Adviser – Wales and Northern Ireland

The Royal Society of Chemistry held its ninth annual Science and the Assembly event on 21st May. Organised by the Society, on behalf of, and in cooperation with, the science and engineering community in Wales, this event has become a firm fixture in the National Assembly for Wales' calendar, and is designed to foster close relations between scientists, Assembly Members and the Welsh Government.

Once again, the event was held at adjacent venues in Cardiff Bay. The historic Pierhead building was the location for the afternoon presentations and its more recent neighbour, the Richard Rogers' designed Senedd, hosted the early evening reception and exhibition.

This year's theme was: *Innovation as a Driver for Growth in the Welsh Economy*.

Professor David Phillips CBE, immediate Past President of the Royal Society of Chemistry, got the proceedings under way. He

Professor David Phillips CBE

took the opportunity of paying tribute to Professor John Harries, Wales' first Chief Scientific Adviser, who had recently retired from his post. During Professor Harries' three year tenure, the Welsh Government had published the *Science for Wales* Strategy, which underpins "the Government's vision to cultivate a strong, dynamic science base, that drives forward the economic and national progression of Wales, to build a solid supportive education system, and to deliver results in the three vital Grand Challenge priority areas, enshrined in the £50m Ser Cymru/Stars Wales project". Under Ser Cymru, three National Research Networks and Research Chairs, are being created, and based on: Life Sciences and health; Low Carbon, energy and; Advanced engineering and materials.

Professor Keith Smith of Cardiff University, and a member of the RSC Council, introduced a distinguished array of speakers:

Wendy Sadler, Director of science made simple, and a member of the Science Advisory Council for Wales, whose presentation asked the question: 'Why is STEM vital for innovation, in Wales?'

Wendy Sadler, Director, science made simple

Dr Gareth Jenkins, Director, Process Research and Development Projects, AMRI Europe. Gareth addressed delegates on the subject of 'Small-scale chemical manufacturing: innovate to survive; innovate to grow; innovate to sustain'.

Professor Peter Heard, Professor of Economic Development and Pro-Vice Chancellor for Research at Glyndwr University, spoke about 'Economic Development: Establishing, a North East Wales Knowledge Industry Corridor'.


Members of the audience for the presentations at the Pierhead

Stuart West, Managing Director, Biocatalysts Ltd, Cardiff, who dealt with the topic: 'Skills and Innovation – the routes to commercial success'.

Beverley Pold, Development and Innovation Manager for Chwarae Teg (Fair Play) covered the subject of 'Influencing the Gender Agenda'.

Professor Ian Cluckie, Pro-Vice Chancellor, Science and Engineering, Swansea University, presented on: 'Innovation in Higher Education via research and co-location'.


Pierhead and Senedd

Professor Chris McGuigan, Professor of Medicinal Chemistry, Cardiff University, delivered the afternoon's final talk on the theme of: 'Life Science in Wales: HUB, Fund and Ser Cymru'.

Professor Jim Iley, Executive Director, for Science and Education, Royal Society of Chemistry, brought proceedings to a close, at the Pierhead, by thanking the speakers for their presentations.

Delegates then joined Assembly Members at the Senedd for the Reception and Exhibition.

The Exhibition was fully subscribed, and supported by the following organisations: the Association of Public Analysts; Association for Science Education; ASTUTE; British Science Association/CREST; Campaign for Science and Engineering; Cardiff University; Central Biotechnology Services; Chwarae Teg; Engineering Education Scheme Wales; Institute of Physics; OCR Cymru; Royal Society of Chemistry; See Science; Society of Biology; science made simple; Society for General Microbiology; The Geological Society of London; the University of South Wales, and the WJEC.

Science and the Assembly was sponsored by representatives of each of the for main political parties: David Rees AM, Chair of the National Assembly's Cross-Party Group on Science and Technology (Labour); Eluned

Prof David Phillips CBE, Simon Thomas AM, David Rees AM, Jeff Cuthbert AM, Eluned Parrott AM, Nick Ramsay AM, Leigh Jeffes

Parrott AM, Shadow Minister for Enterprise, Transport, Europe and Business; Nick Ramsay AM (Liberal Democrat) Chair of the Enterprise and Business Committee, and Shadow Minister for Business, Enterprise, Technology and Science (Conservative); and Simon Thomas AM, Shadow Minister for Education and Skills, and the Welsh Language (Plaid Cymru).

Eluned, Nick and Simon also serve as Vice Chairs of the Cross-Party Group on Science and Technology, which is managed by the Royal Society of Chemistry, in Wales.

Each of the co-sponsoring AMs addressed delegates, and was preceded by Jeff Cuthbert AM, Deputy Minister for Skills and Technology, who stood in for Mrs Edwina Hart MBE AM, Minister for Economy, Science and Transport.

Science and the Assembly 2013 was an extremely successful event, drawing a record number of attendees from across the Welsh science and engineering community.

The Royal Society of Chemistry looks forward to welcoming guests to next year's event, which takes place at the Pierhead and the Senedd, on Tuesday 20th May 2014.

Dr Stephen Benn

Joint Meeting of the Parliamentary Space Committee and Parliamentary and Scientific Committee on Monday 9th September

OUR LIVING SOLAR SYSTEM

The four speakers were:

Dr Lewis Dartnell, Space Research Centre, University of Leicester
Mars – did life ever evolve there and what will future exploration reveal?

Professor Michele Dougherty FRS, Imperial College
Jupiter and Saturn's moons – new hopes for finding life in the Solar System

Professor John Zarnecki, Open University
Time capsules, space hazards or mineral resources: Opportunities for New Space entrepreneurs

Fabio Favata, European Space Agency
Answering the big questions about our planet's place in the Universe

Committee Room 11 was full to capacity for the meeting, which was chaired jointly by Andrew Miller MP and Dr Phillip Lee MP. It was organised in association with European Planetary Science Congress 2013, with several of the delegates in the audience.

HOUSE OF COMMONS SELECT COMMITTEE ON SCIENCE AND TECHNOLOGY

The Science and Technology Committee is established under Standing Order No 152, and charged with the scrutiny of the expenditure, administration and policy of the Government Office for Science, a semi-autonomous organisation based within the Department for Business, Innovation and Skills.

The current members of the Science and Technology Committee are:

Jim Dowd (Labour, Lewisham West and Penge), Stephen Metcalfe (Conservative, South Basildon and East Thurrock), Andrew Miller (Labour, Ellesmere Port and Neston), David Morris (Conservative, Morecambe and Lunesdale), Stephen Mosley (Conservative, City of Chester), Pamela Nash (Labour, Airdrie and Shotts), Sarah Newton (Conservative, Truro and Falmouth), Graham Stringer (Labour, Blackley and Broughton), David Tredinnick (Bosworth), Hywel Williams (Plaid Cymru, Arfon) and Roger Williams (Liberal Democrat, Brecon and Radnorshire).

Andrew Miller was elected by the House of Commons to be the Chair of the Committee on 9 June 2010. The remaining Members were formally appointed to the Committee on 12 July 2010. Caroline Dinenage, Gareth Johnson, Sarah Newton and Hywel Williams were formally appointed to the Committee on 27 February 2012 in the place of Gavin Barwell, Gregg McClymont, Stephen McPartland and David Morris. Jim Dowd was formally appointed to the Committee on 11 June 2012 in the place of Jonathan Reynolds. David Morris was formally re-appointed to the Committee on 3 December 2012 in the place of Gareth Johnson. David Tredinnick was formally appointed to the Committee on 4 February in place of Caroline Dinenage.

CURRENT INQUIRIES

Forensic Science Services (FSS) follow-up

On 22 November 2012, the Committee announced an inquiry: FSS Follow-up. The Committee invited written submissions by 10 January 2013.

On Wednesday 30 January 2013 the Committee took evidence from Alison Fendley, Executive Director, Forensic Archive Ltd, Dr Gill Tully, Consultant, Principal Forensic Services Ltd, and Helen Kenny, Former Branch Secretary for the FSS, Prospect Trade Union.

On Wednesday 6 February 2013 the Committee took evidence from Professor Martin Evison, Director, Northumbria University Centre for Forensic Science (NUCFS), Dr John Manlove, Manlove Forensics Ltd, and David Richardson, Chief Executive, LGC Forensics; and then from Chief Constable Chris Sims, Association of Chief Police Officers (ACPO), Gary Pugh, Director of Forensic Services, Metropolitan Police Service and Kevin Morton, Director of Scientific Support Services, Yorkshire and the Humber.

On Wednesday 13 February 2013 the Committee took evidence from Karen Squibb-Williams MA, Strategic Policy Adviser, Crown Prosecution Service, Michael Turner QC, Chairman, Criminal Bar Association, and Richard Atkinson, Chair of Criminal Law Committee, Law Society.

On Wednesday 6 March 2013 the Committee took evidence from Professor Bernard Silverman, Chief Scientific Adviser, Home Office and Andrew Rennison, Forensic Science Regulator.

On Wednesday 13 March the Committee took evidence from Jeremy Browne MP, Minister of State for Crime Prevention, Home Office and Stephen Webb, Former Director, Finance and Strategy Directorate, Crime and Policing Group, Home Office.

The written and oral evidence received in this inquiry is on the Committee's website. A Report has been agreed and was published on 1 July.

Water Quality

On 19 December 2012, the Committee announced an inquiry: Water Quality. The Committee invited written submissions by 8 February 2013.

On Wednesday 27 February the Committee took evidence from Richard Aylard, Thames Water, Marco Lattughi, Environmental Industries Commission, and Mike Murray, Association of the British Pharmaceutical Industry; and then from Professor Andrew Johnson, Centre for Ecology and Hydrology, Rob Collins, Blueprint for Water Coalition, and NERC; and then from Dr Sue Kinsey, Marine Conservation Society, and Professor Richard Thompson, Plymouth University.

On Monday 4 March 2013 the Committee took evidence from Ian Barker, Head of Water, Land and Biodiversity, Environment Agency, Nick Cartwright, Environment and Business Manager, Environment Agency and Regina Finn, Chief Executive, Ofwat.

On Wednesday 6 March 2013 the Committee took evidence from Peter Gammeltoft, European Commission.

On Wednesday 13 March 2013 the Committee took evidence from Richard Benyon MP, Parliamentary Under-Secretary for Natural Environment, Water and Rural Affairs, Department for Environment, Food and Rural Affairs, Rory Wallace, Head of the Water Framework Directive Team and Dr Caroline Whalley, Priority Substances Policy/Technical Advisor.

The written and oral evidence received in this inquiry is on the Committee's website. A Report has been agreed and was published on 13 June. The Government response to that inquiry was published on 12 September.

Clinical Trials

On 13 December 2012, the Committee announced an inquiry: Clinical Trials. The Committee invited written submissions by 22 February 2013.

On Wednesday 13 March, the Committee took evidence from Professor Sir Michael Rawlins, Chair of the Academy of Medical Sciences Regulation and Governance Review, Dr Keith Bragman, President, Faculty of Pharmaceutical Medicine, and Dr Fiona Godlee, Editor in Chief, British Medical Journal.

On Monday 22 April, the Committee took evidence from Catherine Elliott, Director, Clinical Research Interests, Medical Research Council, Sharmila Nebhrajani, Chief Executive, Association of Medical Research Charities, Professor Peter Johnson, Chief Clinician, Cancer Research UK and Representative from the Wellcome Trust; and then from Dr Bina Rawal, Director of Research, Medical and Innovation, Association of the British Pharmaceutical Industry, Dr James Shannon, Chief Medical Officer, GlaxoSmithKline and Mr William M Burns, Member of the Board of Directors, Roche.

On Wednesday 15 May, the Committee took evidence from Professor Karol Sikora, Medical Director of Cancer Partners UK and Dean, University of Buckingham Medical School and Simon Denegri, NIHR National Director for Public Participation and Engagement in Research and Chair, INVOLVE; Tracey Brown, Managing Director, Sense About Science and Dr Helen Jamison, Deputy Director, Science Media Centre; and Sir Kent Woods, Chief Executive, Medicines and Healthcare products Regulatory Agency; Dr Janet Wisely, Chief Executive, Health Research Authority; Bill Davidson, Acting Deputy Director and Head of Research Standards and Support, Department of Health and Peter Knight, Deputy Director, Head of Research Information and Intelligence, Department of Health.

On Monday 3 June, the Committee took evidence from Rt Hon David Willetts MP, Minister of State for Universities and Science, Department for Business, Innovation and Skills, and the Rt Hon the Earl Howe, Parliamentary Under Secretary of State for Quality, Department of Health.

The written and oral evidence received in this inquiry is on the Committee's website. A Report was published on 17 September.

The European and UK Space Agencies

On 15 February 2013, the Committee announced an inquiry: The European and UK Space Agencies. The Committee invited written submissions by 12 April 2013.

On Wednesday 12 June the Committee took evidence from Professor David Southwood, Imperial College London and Royal Astronomical Society, Professor Alan Smith, Mullard Space Science Laboratory, University College London, Professor Shaun Quegan, Natural Environment Research Council (NERC) and Professor Richard Holdaway, Science and Technology Facilities Council (STFC); John Auburn, Telespazio VEGA UK Ltd, Dr Hugh Lewis, PHS Space Ltd, and Richard Peckham, Astrium.

On Wednesday 3 July, the Committee took evidence from Augusto Gonzalez, European Commission and Jean-Jacques Dordain, European Space Agency.

On Wednesday 10 July the Committee took evidence from David Parker, UK Space Agency, Catherine Mealing-Jones, UK Space Agency and Rob Douglas, UK Space Agency Steering Board; Rt Hon David Willetts MP, Minister of State for Universities and Science, Department for Business, Innovation and Skills and David Parker, UK Space Agency.

The written and oral evidence received in this inquiry is on the Committee's website. A Report is being prepared.

Climate: public understanding and its policy implications

On 28 February 2013 the Committee announced an inquiry: Climate: public understanding and its policy implications. The Committee invited written submissions by 22 April 2013. The Committee expects to hold oral evidence sessions in 2013.

On Wednesday 19 June, the Committee took evidence from Dr Catherine Happer, Glasgow University Media Group, Professor Greg Philo, Glasgow University Media Group, and Tom Sheldon, Senior Press Officer, Science Media Centre.

On Wednesday 26 June, the Committee took evidence from Professor Nick Pidgeon, Understanding Risk Research Group, Cardiff University, Professor Chris Rapley, Communicating Climate Science Policy Commission, UCL, and Dr Alex Burch, Director of Learning, Science Museum Group; Professor John Womersley, Science and Technology Facilities Council and Champion for RCUK Public Engagement with Research, Professor Tim Palmer, Royal Meteorological Society, Professor Rowan Sutton, National Centre for Atmospheric Science and Professor John Pethica, Royal Society.

On Wednesday 17 July, the Committee took evidence from David Jordan, BBC, Ralph Lee, Channel 4 and Fiona Ball, BSkyB Limited; Ros Donald, Carbon Brief, Andrew Montford, Bishop Hill Blog and James Painter, Reuters Institute for the Study of Journalism.

On Monday 9 September, the Committee took evidence from James Randerson, The Guardian, Catherine Brahic, New Scientist; Fiona Harvey, The Guardian, Lewis Smith, Freelance Correspondent and Richard Black, Former BBC Environment Correspondent.

On Wednesday 11 September the Committee took evidence from Tony Grayling, Environment Agency, Phil Rothwell, Environment Agency, Paul Crick, Kent County Council and Katie Stead, Kirklees Council; John Hirst, Met Office and Professor Julia Slingo OBE, Met Office.

REPORTS

Forensic science

On 25 July 2013, the Committee published its Second Report of Session 2013-14, *Forensic science*, HC 610

GOVERNMENT RESPONSES

Government Response to the Committee's report 'Marine Science', the Committee's Ninth Report of Session 2012-13

On 3 July 2013 the Committee published the Government Response to the Committee's report on Marine science.

Government Response to the Committee's report 'Bridging the Valley of Death: improving the commercialisation of research', the Committee's Eighth Report of Session 2012-13

On 11 July 2013 the Committee published the Government Response to the Committee's report on Bridging the Valley of Death.

FURTHER INFORMATION

Further information about the work of the Science and Technology Committee or its current inquiries can be obtained from the Clerk of the Committee, Stephen McGinness, or from the Senior Committee Assistant, Darren Hackett, on 020 7219 2792/2793 respectively; or by writing to: The Clerk of the Committee, Science and Technology Committee, House of Commons, 7 Millbank, London SW1P 3JA. Enquiries can also be e-mailed to

scitechcom@parliament.uk. Anyone wishing to be included on the Committee's mailing list should contact the staff of the Committee. Anyone wishing to submit evidence to the Committee is strongly recommended to obtain a copy of the guidance note first. Guidance on the submission of evidence can be found at www.parliament.uk/commons/selcom/witguide.htm. The Committee has a website, www.parliament.uk/science, where all recent publications, terms of reference for all inquiries and press notices are available.

HOUSE OF LORDS SCIENCE AND TECHNOLOGY SELECT COMMITTEE

The members of the Committee (appointed 16 May 2013) are Lord Dixon-Smith, Baroness Hilton of Eggardon, Lord O'Neill of Clackmannan, Lord Krebs (Chairman), Baroness Manningham-Buller, Lord Patel, Lord Peston, Baroness Perry of Southwark, Lord Rees of Ludlow, the Earl of Selborne, Baroness Sharp of Guildford, Lord Wade of Chorlton, Lord Willis of Knaresborough and Lord Winston.

Scientific infrastructure

The Committee launched an inquiry into scientific infrastructure in May 2013. The call for evidence closed on 22 June. Oral evidence was taken across June and July on the large and medium-sized scientific infrastructure currently available in the UK with a particular focus on: future needs and strategic planning, funding and governance arrangements, international partnerships and partnerships with industry. The Committee hope to publish its report in the autumn.

Waste and the bioeconomy

The Committee launched an inquiry into waste and the bioeconomy towards the end of July 2013. The Call for Evidence closed on 27 September. The inquiry will collect evidence on the technology used to exploit bio-waste and waste gases in order to generate high-value products. The inquiry aims to assess the potential for this technology to enable bio-waste and waste gas to replace current feedstocks and the potential contribution this could make to a bioeconomy. It is anticipated that oral evidence will be taken in the autumn and the Committee will report in late 2013 or early 2014.

Regenerative medicine

The Committee launched an inquiry into regenerative medicine before the 2012 summer recess. A group from the Committee visited the California Institute for Regenerative Medicine. Oral evidence was taken from October to March 2013. The Committee reported on 1 July 2013 and a Government response is expected in the autumn.

Nuclear follow-up

The Committee undertook an evidence session with Professor David Mackay, Chief Scientific Advisor at the Department of Energy & Climate Change, in July 2013 to follow up on its November 2011 report, Nuclear research and development capabilities. It is anticipated that the Committee will hear from the Minister for Energy, Michael Fallon MP, in the autumn.

Science spend

In May 2013, ahead of the Comprehensive Spending Review, the Committee held a one-off evidence session on the topic of science spend. This resulted in a letter being sent to the Chancellor of the Exchequer on 4 June 2013 calling for an increase in the science budget.

Open access

The Committee undertook a short inquiry into the implementation of the Government's open access policy. It issued a targeted call for evidence to key stakeholders for this short inquiry. The Committee took oral evidence in January 2013 and published its report in February. The report was debated on 28 February. It followed this up with a letter to RCUK expressing concern about its revised open access policy in March. A Government response to the report was published in May 2013.

Higher Education in Science, Technology, Engineering and Maths (STEM) subjects

The Committee's report was debated on the floor of the House on 21 March 2013.

Sports and exercise science and medicine

In May 2012, the Select Committee launched a short inquiry into sports and exercise science and medicine to consider how the legacy of London 2012 could be used to improve understanding of the benefits exercise can provide for the wider public and in treating chronic conditions. The Committee explored how robust this science is and how lessons learnt from the study of athletes can be applied to improve the health of the population generally. The Committee held a seminar on 29th May 2012, and took oral evidence during the month of June from sports and exercise scientists and clinicians, UK Sport, and officials and Ministers from the Department of Health and the Department for Culture, Media and Sport. The Committee published its report on 17 July 2012. The Government response was received in October 2012.

FURTHER INFORMATION

The reports, Government responses, written and oral evidence to the Committee's inquiries mentioned above, as well as the Calls for Evidence and other documents can be found on the Committee's website. Further information about the work of the Committee can be obtained from Chris Clarke, Committee Clerk, clarkechr@parliament.uk or 020 7219 4963. The Committee Office email address is hlscience@parliament.uk.

HOUSE OF COMMONS LIBRARY SCIENCE AND ENVIRONMENT SECTION

Scientists and other staff in the Science and Environment Section provide confidential, bespoke briefing to Members and their offices on a daily basis. They also provide support to Commons Select Committees, and produce longer notes and research papers which can be accessed on line at http://www.parliament.uk/topics/topical-issues.htm.

Opposite are summaries of some recently updated published briefings.

For further information contact Dr Patsy Richards Head of Section Tel: 020 7219 1665 email: richardspa@parliament.uk

. . . regulated through the International Seabed Authority. . .

. . . policies on onshore wind development . . .

RECENT PUBLICATIONS

Comparison of the planning system in the four UK countries

RP 13/39

This is a collaborative research paper, with contributions from colleagues in the National Assembly for Wales Research Service, Northern Ireland Assembly Research & Information Service and the Scottish Parliament Information Centre.

Deep Sea Mining Bill 2013-14

SN/SC/6722

Mrs Sheryll Murray MP, who came fourth in the ballot for Private Members' Bills, has introduced the Deep Sea Mining Bill (HC Bill 14). This is a Government 'handout' Bill; the Foreign and Commonwealth Office has prepared its explanatory notes.

The Bill seeks to amend the Deep Sea Mining (Temporary Provisions) Act 1981. This will ensure that companies seeking to exploit mineral resources of the deep sea bed obtain licences from and are regulated through the International Seabed Authority, in line with the UN Convention on the Law of the Sea.

Also, at the moment, the 1981 Act applies only to polymetallic nodules, not to other mineral resources of the deep sea bed. The Bill's second reading was on Friday 6 September 2013. Environmental groups have voiced concerns about increasing numbers of applications to explore for minerals in the deep sea, and whether environmental assessment and controls are strong enough.

Planning for onshore wind

SN/SC/ 4370

This sets out issues to do with the planning process for onshore wind development and proposals for reform. It applies to England only. Some examples of reasons for acceptance and rejection of wind farms are set out.

The planning process used to determine onshore wind development will depend on the size of the proposed development. Planning policy for onshore wind is contained in a number of documents, principally the Government's National Planning Policy Framework, the National Policy Statement for Renewable Energy Infrastructure and Planning practice guidance for renewable and low carbon energy. Local authorities will have policies on onshore wind development in any up-to-date local plan.

The Planning practice guidance for renewable and low carbon energy was published in July 2013. The Government's aim in this guidance was to make clear that the need for renewable energy did not automatically override environmental protections and the planning concerns of local communities. The proposal will not give communities a veto over wind development. Compulsory pre-application engagement is also proposed for "more significant onshore wind", but the Government has not yet defined what this will mean. The Government has also proposed that communities should receive an increased community benefit when an onshore wind farm is accepted in their area.

CAP Reform 2014-2020: Reaching Agreement

SN/SC/6693

The EU Council of Ministers, European Parliament and Commission came to an agreement on the future rules for the Common Agricultural Policy (CAP) at the end of June 2013. This follows two years of negotiation since the Commission published detailed reform proposals.

The new agreement includes: a new Basic Payment scheme which will represent 70% of a Member State's Direct Payments to farmers, a requirement to use 30% of their allocation to give a 'greening payment' to farmers for required farming practices supporting environmental improvements, and an end to sugar beet production quotas in 2017. Most Direct Payment

(Pillar 1) reforms will come into play in January 2015 with 2014 acting as a transitional year.

. . . not the genuine reform that it had been hoping for . . .

The Government has said that the package agreed is an acceptable outcome for the UK but is not the genuine reform that it had been hoping for. However, the UK Government did secure a great deal of flexibility within the package for Member States to tailor their national approaches to their own particular needs. This should be a benefit for UK farmers but implementation details are still being developed nationally and regionally. The exact impacts of the new arrangements for UK farmers are still not clear.

The National Farmers Union is concerned that the UK will use the considerable flexibility within the agreement to reduce Direct Payments to farmers and to "goldplate" the environmental requirements. Meanwhile, the greening element of the agreement has been criticised by some environmental organisations as a missed opportunity by not going far enough. Some parts of the agreement are still under discussion as they were dependent on the agreement of the EU budget. Negotiations regarding transfers of funding between Pillars 1 and 2, external convergence and restrictions on the highest subsidies are now being overseen by the Lithuanian Presidency and are expected to be finalised in December 2013.

Regulation of Herbal Medicines

SN/SC/6002

. . . prohibiting the continued sale of unlicensed products . . .

This outlines the historical regulation of herbal medicines in the UK, regulatory changes due to the EU Directive on Traditional Herbal Medicinal Products, and proposals to introduce statutory licensing of herbal practitioners.

Herbal remedies for human use have been regarded as medicines under UK legislation, in principle subject to the same extensive licensing procedures as pharmaceuticals. In recognition of a long history of safe use they have historically been exempted from licensing. A review of regulation at EU level was prompted by safety concerns and the market harmonisation impact of varying herbal regulatory regimes.

The Directive on Traditional Herbal Medicinal Products (Directive 2004/24/EC) replaces most existing member state regulations and creates a harmonised licensing system for traditional herbal medicine products (in use for at least 30 years, of which 15 must have been in the EU). The Directive came into effect on 30 April 2011.

The Directive applies most directly to manufactured herbal medicines sold over the counter, prohibiting the continued sale of unlicensed products. In the UK, specific exemptions continue to apply to preparations made up by herbal practitioners for individual patients. The Directive has met with considerable opposition from suppliers and users. Objections include disproportionate costs of regulatory compliance and unfair treatment of non-European herbal traditions, with a resulting threat to the viability of small and medium-sized businesses and a reduction in consumer choice.

ACTIVITIES

During the Summer recess the section remained busy advising Members and their offices on issues which continued to be topical, including energy policy and fracking proposals, changes to the planning regime, the badger cull and organ donation. It also continued to provide advice to Select Committees.

Members of the section attended The Society of Biology's Parliamentary Links Day on Science and Diversity, the Royal Town Planning Institute Parliamentary reception, and met with external contacts including Ofgem, the RSPB, and delegates from the Chartered Institution of Water and Environmental Management.

Dr Richards visited Brussels to meet colleagues working on the European Parliament's environment and industry committees, at the UK Permanent Representation, and in the Commission (DGs Climate Action and Energy). This was arranged by the UK National Parliament Office in Brussels.

PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY (POST)

RECENT POST PUBLICATIONS

Invasive Alien Plant Species

July 2013 *POSTnote 439*

Some alien plant species can become invasive and have detrimental ecological, social and economic effects. This POSTnote summarises debate over the risks posed by such plant species and the policy frameworks and measures for addressing these risks.

Drug Driving

September 2013 *POSTnote 440*

The Government has created a new offence of drug-driving based on set drug limits and is introducing drug screening devices to improve the detection of drug-drivers. This POSTnote examines the drug screening devices available for detecting drug drivers and options for the setting of drug limits for the new offence.

Organ Donation and Transplants

September 2013 *POSTnote 441*

Transplants are the most effective treatment for organ failure but demand for organs outstrips supply. The NHS estimates the transplant programme saves more than £300 million every year. The Human Transplantation (Wales) Bill passed by the National Assembly for Wales revises the current opt-in consent procedure for donations to deemed consent. A new UK strategy sets out policy intended to improve organ transplant rates. This POSTnote examines this and other policies to increase the availability of donor organs in the UK.

Reversing Insect Pollinator Decline

September 2013 *POSTnote 442*

Pollination by insects enables the reproduction of flowering plants and was estimated to be worth £603 million to UK Agriculture in 2010. Insect Pollinators are declining globally, with implications for food security and wild habitats. This POSTnote summarises causes, gaps in knowledge and possible strategies for halting pollinator decline.

Autonomous Road Vehicles

September 2013 *POSTnote 443*

Vehicles capable of driving without human intervention are rapidly moving up the policy agenda. Legislation in Nevada, California and Florida now means that they are being tested on public roads for the first time. This POSTnote reviews recent technological and policy developments in this area. It looks at how road safety, the environment and congestion could be affected, and examines barriers to adoption.

Cosmetic Procedures

September 2013 *POSTnote 444*

Cosmetic treatments are becoming increasingly popular in the UK. A review commissioned by the Department of Health (DH) in response to the Poly Implant Prothèse (PIP) breast implant scandal identified a range of concerns about the sector. This POSTnote summarises the procedures on offer, the factors driving the increase in demand, and the health, ethical and regulatory issues that arise.

Pre-implantation Genetic Diagnosis

September 2013 *POSTnote 445*

Pre-implantation genetic diagnosis (PGD), used in combination with IVF, allows families with a history of a serious genetic disorder to have a child unaffected by the condition. This POSTnote covers the applications of PGD in the UK and how the technology is regulated.

CURRENT WORK

Biological Sciences – HIV Prevention in the UK, Minimum Age of Criminal Responsibility, Epigenetics and Health, Khat, Greenhouse Gas Emissions from livestock, Cosmetic Procedures and Organ Transplants.

Environment and Energy – Intermittent Electricity Generation, Demand Side Response, Urban Green Infrastructure, Antimicrobial Resistance in the Environment, Negative Emissions Technologies, Short lived Climate Pollutants and Climate Change Feedbacks.

Physical sciences and IT – Telehealth and Telecare, Big Data and Computer Science Education.

CONFERENCES AND SEMINARS

Science for MPs' Researchers

On 16th July, POST and the House of Commons Library Science and Environment Section (SES) held an event for MPs Researchers to:

- advise them of the range of science advice and resources available in Parliament for Members and their staff;
- meet staff from POST and SES and tell them about the science and technology issues that matter to their MP and constituency; and,
- have the opportunity to suggest areas of research and future POSTnote topics based on the concerns of their MP and constituency.

The event was chaired by the POST chairman, Adam Afriyie, MP for Windsor, with a presentation from Dr Sarah Bunn, POST Biological Sciences and Health Adviser.

Social Science in Parliament: Improving the Evidence Base for Policy

On 10th September, POST hosted a parliamentary seminar to launch its new dedicated Social Science Section, which has been established through a partnership with the Economic and Social Research Council (ESRC) and the support of University College London (UCL). The seminar brought together parliamentarians and external experts from across the social sciences to discuss the role of social science in Parliament, how social science can improve the evidence base for policy making and the role of the new Social Science Section at POST.

It was Chaired by Kelvin Hopkins MP, the Chair of the All-Party Parliamentary Group for Social Science and Policy, and presentations were made by: Adam Afriyie MP, Chair of POST;
Dr David Halpern, National Adviser of the What Works Centres and Director of the Cabinet Office Behavioural Insights Team; Professor Teresa Rees CBE AcSS, Board Member of the Campaign for Social Science and former Pro Vice Chancellor (Research), Cardiff University; Ms Jane Tinkler, Manager of the Public Policy Group and Research Fellow at the Department of Government, LSE; Professor Paul Boyle, Chief Executive, ESRC; and Baroness Lister of Burtersett CBE FBA, Emeritus Professor of Social Policy, Loughborough University.

POST Annual Reception

On 10th September, POST, in conjunction with the Economic and Social Research Council (ESRC) and University College London (UCL), hosted its first annual reception. It marked the launch of the new Social Science Section at POST, and was an opportunity to raise awareness about it to a wide audience and to encourage engagement with its future work. There were brief presentations from each of the organisations involved in establishing the new Social Science Section at POST to outline why they supported it and what they hope it can achieve: Adam Afriyie MP, Chair of POST; Professor Paul Boyle, Chief Executive, ESRC; and Professor David Price (UCL Vice-Provost (Research). Lord Winston gave the keynote address.

Halting Insect Pollinator Declines

On 12th September, POST hosted a parliamentary seminar in conjunction with the British Ecological Society (BES) to review the

threats facing insect pollinators, identify important gaps in knowledge and explore the strategies available to halt declines. Pollinating insects are in decline globally, due to multiple and interacting pressures. The pollination services they provide are important for the functioning of our ecosystems and food security, and were estimated to be worth £603 million to UK agriculture in 2010. Pollination in the UK is undertaken by a wide variety of insect species, such as bees, hoverflies, flies, beetles, butterflies and moths. To take effective action to halt declines requires understanding of why they are occurring. At this event, chaired by Sarah Newton MP, presentations were made by Dr Lynn Dicks, Research Associate and NERC Knowledge Exchange Fellow, Cambridge University, Professor Bill Kunin, Professor of Ecology, Leeds University, Matt Shardlow, Chief Executive, Buglife and Professor Simon Potts, Professor of Biodiversity and Ecosystem Services, Reading University and Member of the Defra Expert Working Group on Pollinators.

STAFF, FELLOWS AND INTERNS AT POST

Fellows

Brett Edwards, Bath University, Wellcome Trust
Dave Parker, University of Bristol, RSoC
Luke Gibbon, University of Strathclyde, Wellcome Trust
Amy Zhang, University of Cambridge, RSoC
Paul Coleman, University of Birmingham, BBSRC
Rory O'Connor, Centre for Ecology and Hydrology, BES
Steve Aston, Swansea University, NERC
Eleanor Walton, York University, BBSRC
Becky Wilebore, University of Cambridge, NERC
Anne Claire Pawsey, University of Edinburgh, EPSRC
Christophe Mazur, Imperial College London, Grantham Institute
David Ross, Herriot-Watt University, IoP

Staff

Dr Abbi Hobbs, POST Social Science adviser, joined POST in July 2013.

Dr Chandrika Nath, POST Deputy Director and Physical Sciences adviser is taking maternity leave from October 2013.

Dr Lydia Harriss from the Wellcome Trust is joining POST as Physical Sciences and ICT Adviser from October 2013.

Carla Leanne Washbourne from the School of Civil Engineering and GeoSciences at Newcastle University is joining POST as Physical Sciences and ICT Adviser from October 2013.

Selected Debates
Listed opposite (grouped by subject area) is a selection of Debates on matters of scientific interest which took place in the House of Commons, House of Lords or Westminster Hall between 24th June and 13th September.

SELECTED DEBATES

AGRICULTURE			
Beef Cattle and Sheep (Carbon Footprint)	26.6.13	HoC 102WH	Neil Parish
DEFENCE			
Dalgety Bay (Radiation)	9.7.13	HoC 331	Gordon Brown
Drones: Code of Conduct	25.6.13	HoL 719	Lord Judd
EDUCATION			
Careers Advice in Schools	24.6.13	HoC 120	Gordon Birtwistle
Museum of Science and Industry	26.6.13	HoC 75WH	Debbie Abrahams
Part-Time Study	24.7.13	HoL GC508	Baroness Bakewell
ENERGY			
EU: Energy Infrastructure (EUC Report)	29.7.13	HoL GC583	Lord Carter of Coles
UK Shale Gas	18.7.13	HoC 307WH	Caroline Lucas
HEALTH			
Antibiotic-Resistant Bacterial Infections	24.7.13	HoL GC494	Lord Crisp
Arts: Contribution to Education, Health and Emotional Well-being	25.7.13	HoL 1508	Baroness Jones of Whitchurch
Brain Tumours in Children	3.9.13	HoC 64WH	Dominic Raab
Herbal Medicine (Regulation)	9.7.13	HoC 1WH	David Tredinnick
HPV Vaccine	2.7.13	HoC 893	Mike Freer
Mitochondrial Disease	25.6.13	HoC 60WH	Chi Onwurah
NHS: Association of Medical Research Charities Report	27.6.13	HoL GC300	Lord Turnberg
INTERNATIONAL DEVELOPMENT			
Post-2015 Development Goals	4.7.13	HoC 315WH	Sir Malcolm Bruce
Women: Developing Countries	27.6.13	HoL 911	Lord Loomba
TRANSPORT			
Rail 2020	3.7.13	HoC 987	Louise Ellman

SCIENCE DIRECTORY

THE FOLLOWING ORGANISATIONS HAVE ENTRIES IN THE SCIENCE DIRECTORY:

Association of the British Pharmaceutical Industry
AIRTO
AMPS
Biochemical Society
The British Ecological Society
British In Vitro Diagnostics Association (BIVDA)
British Measurement and Testing Association (BMTA)
British Nutrition Foundation
British Pharmacological Society
British Psychological Society
British Science Association
British Society for Antimicrobial Chemotherapy
British Society for Immunology
Cavendish Laboratory
Chartered Institute of Patent Attorneys
Clifton Scientific Trust
The Council for the Mathematical Sciences
Eli Lilly and Company Ltd
EngineeringUK
The Food and Environment Research Agency
GAMBICA Association Ltd
The Geological Society
Institute of Food Science & Technology
Institute of Marine Engineering, Science and Technology (IMarEST)
The Institute of Measurement & Control
Institute of Physics
Institute of Physics and Engineering in Medicine
Institution of Chemical Engineers
Institution of Civil Engineers
Institution of Engineering Designers
The Institution of Engineering and Technology
Institution of Mechanical Engineers
LGC
The Linnean Society
L'Oréal
Marine Biological Association
Met Office
MSD
National Physical Laboratory
Natural History Museum
NEF: The Innovation Institute
Nesta
PHARMAQ Ltd
The Physiological Society
Prospect
The Royal Academy of Engineering
Royal Botanic Gardens, Kew
The Royal Institution
The Royal Society
The Royal Society of Chemistry
Society for Applied Microbiology
Society for General Microbiology
Society of Biology
Society of Chemical Industry
Society of Cosmetic Scientists
Society of Maritime Industries
Universities Federation for Animal Welfare
The Welding Institute

Research Councils UK
Biotechnology and Biological Sciences Research Council (BBSRC)
Economic and Social Research Council (ESRC)
Engineering and Physical Sciences Research Council (EPSRC)
Medical Research Council (MRC0
Natural Environment Research Council (NERC)
Science and Technology Facilities Council (STFC)

Association of the British Pharmaceutical Industry

abpi
Bringing medicines to life

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The ABPI is the voice of the innovative pharmaceutical industry, working with Government, regulators and other stakeholders to promote a receptive environment for a strong and progressive industry in the UK, one capable of providing the best medicines to patients.

The ABPI's mission is to represent the pharmaceutical industry operating in the UK in a way that:

- assures patient access to the best available medicine;
- creates a favourable political and economic environment;
- encourages innovative research and development;
- affords fair commercial returns

AIRTO

airto
making innovation happen

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AIRTO – The Association for Independent Research and Technology Organisations – is the foremost membership body for organisations operating in the UK's intermediate research and technology sector. AIRTO's members deliver vital innovation and knowledge transfer services which include applied and collaborative R&D, frequently in conjunction with universities, consultancy, technology validation and testing, incubation of commercialisation opportunities and early stage financing. AIRTO members have a combined turnover of over £4bn from clients both at home and outside the UK, and employ over 40,000 scientists, technologists and engineers.

AMPS

AMPS
The Association of Management and Professional Staffs.

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Tony Harding
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Website: www.amps-tradeunion.com

We are a Trades Union for Management and Professional Staff working in the pharmaceutical, chemical and allied industries.

We also have a section for Professional Divers working globally. We represent a broad base of both office and field based staff and use our influence to improve working conditions on behalf of our members.

We are experts in performance based and field related issues and are affiliated to our counterparts in EU Professional Management Unions.

Biochemical Society

Biochemical Society
Advancing Molecular Bioscience

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The Biochemical Society exists to promote and support the Molecular and Cellular Biosciences. We have over 6000 members in the UK and abroad, mostly research bioscientists in universities or in industry. The Society is also a major scientific publisher. In addition, we promote science policy debate and provide resources, for teachers and pupils, to support the bioscience curriculum in schools. Our membership supports our mission by organizing scientific meetings, sustaining our publications through authorship and peer review and by supporting our educational and policy initiatives.

The British Ecological Society

British Ecological Society

The British Ecological Society
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Ecology into Policy Blog
http://britishecologicalsociety.org/blog/
Twitter: @BESPolicy

The British Ecological Society's mission is to advance ecology and make it count. The Society has over 4,000 members worldwide. The BES publishes five internationally renowned scientific journals and organises the largest scientific meeting for ecologists in Europe. Through its grants, the BES also supports ecologists in developing countries and the provision of fieldwork in schools. The BES informs and advises Parliament and Government on ecological issues and welcomes requests for assistance from parliamentarians.

British In Vitro Diagnostics Association (BIVDA)

BIVDA

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BIVDA is the UK industry association representing companies who manufacture and/or distribute the diagnostics tests and equipment to diagnose, monitor and manage disease largely through the NHS pathology services. Increasingly diagnostics are used outside the laboratory in community settings and also to identify those patients who would benefit from specific drug treatment particularly for cancer.

British Measurement & Testing Association (BMTA)

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Website: www.bmta.co.uk

BMTA is the trade and technology association for laboratory-based organisations and testing and calibration service providers. We have over 100 member companies representing the interests of over 450 UKAS accredited laboratories. BMTA provides its members with a wide range of liaison, lobbying, technical event and information services. BMTA is also very active in training initiatives and provides its members with access to European issues through our membership of EUROLAB.

British Nutrition Foundation

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www.foodafactoflife.org.uk

The British Nutrition Foundation (BNF) was established over 40 years ago and exists to deliver authoritative, evidence-based information on food and nutrition in the context of health and lifestyle. The Foundation's work is conducted and communicated through a unique blend of nutrition science, education and media activities.

BPS BRITISH PHARMACOLOGICAL SOCIETY

Today's science, tomorrow's medicines

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The British Pharmacological Society is the primary UK learned society concerned with research into drugs and the way they work. Our 3000+ members work in academia, industry, regulatory agencies and the health services, and many are medically qualified. We cover the whole spectrum of pharmacology, including laboratory, clinical, and toxicological aspects. Inquiries about the discovery, development and application of drugs are welcome.

The British Psychological Society

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The British Psychological Society is an organisation of over 48,000 members governed by Royal Charter. It maintains the Register of Chartered Psychologists, publishes books, 11 primary science Journals and organises conferences. Requests for information about psychology and psychologists from parliamentarians are very welcome.

British Science Association

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Our vision is a society in which people are able to access science, engage with it and feel a sense of ownership about its direction. In such a society science advances with, and because of, the involvement and active support of the public.

Established in 1831, the British Science Association is a registered charity which organises major initiatives across the UK, including National Science and Engineering Week, the British Science Festival, programmes of regional and local events and the CREST programme for young people in schools and colleges. We provide opportunities for all ages to discuss, investigate, explore and challenge science.

British Society for immunology

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The BSI is one of the oldest, largest and most active immunology societies in the world. We have over 4,000 members who work in all areas of immunology, including research and clinical practice.

The BSI runs major scientific meetings, education programmes and events for all ages. We disseminate top quality scientific research through our journals and meetings and we are committed to bringing the wonders and achievements of immunology to as many audiences as possible.

British Society for Antimicrobial Chemotherapy

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Founded in 1971, and with 800 members worldwide, the Society exists to facilitate the acquisition and dissemination of knowledge in the field of antimicrobial chemotherapy. The BSAC publishes the *Journal of Antimicrobial Chemotherapy* (JAC), internationally renowned for its scientific excellence, undertakes a range of educational activities, awards grants for research and has active relationships with its peer groups and government.

Cavendish Laboratory

UNIVERSITY OF CAMBRIDGE

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The Cavendish Laboratory houses the Department of Physics of the University of Cambridge.

The research programme covers the breadth of contemporary physics

Extreme Universe: Astrophysics, cosmology and high energy physics

Quantum Universe: Cold atoms, condensed matter theory, scientific computing, quantum matter and semiconductor physics

Materials Universe: Optoelectronics, nanophotonics, detector physics, thin film magnetism, surface physics and the Winton programme for the physics of sustainability

Biological Universe: Physics of medicine, biological systems and soft matter

The Laboratory has world-wide collaborations with other universities and industry

Chartered Institute of Patent Attorneys

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Members of CIPA practise in intellectual property, especially patents, trade marks, designs, and copyright, either in private partnerships or industrial companies. Through its new regulatory Board, CIPA maintains the statutory Register. It advises government and international circles on policy issues and provides information services, promoting the benefits to UK industry of obtaining IP protection, and to overseas industry of using British attorneys to obtain international protection.

Clifton Scientific Trust

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Science for Citizenship and Employability, Science for Life, Science for Real

We build grass-roots partnerships between school and the wider world of professional science and its applications

- for young people of all ages and abilities
- experiencing science as a creative, questioning, human activity
- bringing school science added meaning and notivation, from primary to post-16
- locally, nationally, internationally (currently between Britain and Japan)

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The Council for the Mathematical Sciences

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The Council for the Mathematical Sciences is an authoritative and objective body that works to develop, influence and respond to UK policy issues affecting mathematical sciences in higher education and research, and therefore the UK economy and society by:

- providing expert advice;
- engaging with government, funding agencies and other decision makers;
- raising public awareness; and
- facilitating communication between the mathematical sciences community and other stakeholders

Eli Lilly and Company Ltd

Answers That Matter.

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Lilly UK is the UK affiliate of a major American pharmaceutical manufacturer, Eli Lilly and Company of Indianapolis. This affiliate is one of the UK's top pharmaceutical companies with significant investment in science and technology including a neuroscience research and development centre and bulk biotechnology manufacturing operations.

Lilly medicines treat schizophrenia, diabetes, cancer, osteoporosis, attention deficit hyperactivity disorder, erectile dysfunction, depression, bipolar disorder, heart disease and many other diseases.

EngineeringUK

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EngineeringUK is an independent organisation that promotes the vital role of engineers, engineering and technology in our society. EngineeringUK partners business and industry, Government and the wider science and technology community: producing evidence on the state of engineering; sharing knowledge within engineering, and inspiring young people to choose a career in engineering, matching employers' demand for skills.

The Food and Environment Research Agency

fera
The Food and Environment Research Agency

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The Food and Environment Research Agency's over arching purpose is to support and develop a sustainable food chain, a healthy natural environment, and to protect the global community from biological and chemical risks.

Our role within that is to provide robust evidence, rigorous analysis and professional advice to Government, international organisations and the private sector.

GAMBICA Association Ltd

GAMBICA
AUTOMATION INSTRUMENTATION & CONTROL LABORATORY TECHNOLOGY

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GAMBICA Association is the UK trade association for instrumentation, control, automation and laboratory technology. The association seeks to promote the successful development of the industry and assist its member companies through a broad range of services, including technical policy and standards, commercial issues, market data and export services.

The Geological Society

The Geological Society
serving science & profession

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The Geological Society is the national learned and professional body for Earth sciences, with 11,000 Fellows (members) worldwide. The Fellowship encompasses those working in industry, academia and government, with a wide range of perspectives and views on policy-relevant science, and the Society is a leading communicator of this science to government bodies and other non-technical audiences.

Institute of Food Science & Technology

IFST

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IFST is the independent qualifying body for food professionals in Europe. Membership is drawn from all over the world from backgrounds including industry, universities, government, research and development and food law enforcement.

IFST's activities focus on disseminating knowledge relating to food science and technology and promoting its application. Another important element of our work is to promote and uphold standards amongst food professionals.

Institute of Marine Engineering, Science and Technology (IMarEST)

Institute of Marine Engineering, Science & Technology
IMAREST

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Established in London in 1889, the IMarEST is a leading international membership body and learned society for marine professionals, with over 15,000 members worldwide. The IMarEST has an extensive marine network of 50 international branches, affiliations with major marine societies around the world, representation on the key marine technical committees and non-governmental status at the International Maritime Organization (IMO) as well as other intergovernmental organisations.

The Institute of Measurement and Control

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The Institute of Measurement and Control provides a forum for personal contact amongst practiioners, publishes learned papers and is a professional examining and qualifying organisation able to confer the titles EurIng, CEng, IEng, EngTech; Companies and Universities may apply to become Companions. Headquartered in London, the Institute has a strong regional base with 15 UK, 1 Hong Kong and 1 Malaysia Local Section, a bilateral agreement with the China Instrument Society and other major international links.

IOP Institute of Physics

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The Institute of Physics is a leading scientific society. We are a charitable organisation with a worldwide membership of around 50,000, working together to advance physics education, research and application.

We engage with policymakers and the general public to develop awareness and understanding of the value of physics and, through IOP Publishing, we are world leaders in professional scientific communications. Visit us at www.iop.org.

Institute of Physics and Engineering in Medicine

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IPEM is a registered, incorporated charity for the advancement, in the public interest, of physics and engineering applied to medicine and biology. It accredits medical physicists, clinical engineers and clinical technologists through its membership register, organises training and CPD for them, and provides opportunities for the dissemination of knowledge through publications and scientific meetings. IPEM is licensed by the Science Council to award CSci, RSci and RSciTech, and by the Engineering Council to award CEng, IEng and EngTech.

IChemE

ADVANCING CHEMICAL ENGINEERING WORLDWIDE

The Institution of Chemical Engineers

With membership approaching 38,000 members in 120 countries, IChemE is the global membership organisation for chemical engineers. A not for profit organisation, we serve the public interest by building and sustaining an active professional community and promoting the development, understanding and application of chemical engineering worldwide.

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Institution of Civil Engineers

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Representing over 80,000 professional civil engineers around the world, ICE actively contributes to the development of public policy at all levels of government in areas concerning infrastructure, engineering and our quality of life.

Established in 1818, ICE is recognised worldwide for its excellence as a centre of learning, as a qualifying body and as a public voice for the profession. Our members design, build and maintain the infrastructure that keeps our country running.

Under our Royal Charter, we have a duty to provide independent, expert advice on infrastructure issues for the benefit of the public and to serve wider society. We are seen by Parliament and industry alike as the authoritative voice of infrastructure.

Institution of Engineering Designers

iED support inspire achieve

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The only professional membership body solely for those working in engineering and technological product design. Engineering Council and Chartered Environmentalist registration for suitably qualified members. Membership includes experts on a wide range of engineering and product design disciplines, all of whom practise, manage or educate in design.

IET

The Institution of Engineering and Technology

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The IET is a world leading professional organisation, sharing and advancing knowledge to promote science, engineering and technology across the world. Dating back to 1871, the IET has 150,000 members in 127 countries with offices in Europe, North America, and Asia-Pacific.

Institution of Mechanical Engineers

Institution of MECHANICAL ENGINEERS

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The Institution provides politicians and civil servants with information, expertise and advice on a diverse range of subjects, focusing on manufacturing, energy, environment, transport and education policy. We regularly publish policy statements and host political briefings and policy events to establish a working relationship between the engineering profession and parliament.

LGC

LGC *Setting standards in analytical science*

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LGC is an international science-based company and market leader in the provision of analytical, forensic and diagnostic services and reference standards to customers in the public and private sectors.

Under the Government Chemist function, LGC fulfils specific statutory duties as the referee analyst and provides advice for Government and the wider analytical community on the implications of analytical chemistry for matters of policy, standards and regulation. LGC is also the UK's designated National Measurement Institute for chemical and biochemical analysis.

With headquarters in Teddington, South West London, LGC has 36 laboratories and centres across Europe and at sites in China, Brazil, India, South Africa and the US.

The Linnean Society of London

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The Linnean Society of London is a professional learned body which promotes natural history in all its branches, and was founded in 1788. The Society is particularly active in the areas of biodiversity, conservation and sustainability, supporting its mission through organising open scientific meetings and publishing peer-reviewed journals, as well as undertaking educational initiatives. The Society's Fellows have a considerable range of biological expertise that can be harnessed to inform and advise on scientific and public policy issues.

A Forum for Natural History

L'ORÉAL UK AND IRELAND

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L'Oréal employs more than 3,500 scientists around the world and dedicates over €600 million each year to research and innovation in the field of healthy skin and hair. The company collaborates with a vast number of institutions in the UK and globally.

Marine Biological Association

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For over 125 years the Marine Biological Association has been delivering its mission *'to promote scientific research into all aspects of life in the sea, including the environment on which it depends, and to disseminate to the public the knowledge gained.'* The MBA has extensive research and knowledge exchange programmes and a long history of providing evidence to support policy. It represents its members in providing a clear independent voice to government on behalf of the marine biological community.

Met Office

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The Met Office doesn't just forecast the weather on television. Our forecasts and warnings protect UK communities and infrastructure from severe weather and environmental hazards every day – they save lives and money. Our Climate Programme delivers evidence to underpin Government policy. Our Mobile Meteorological Unit supports the Armed Forces around the world. We build capacity overseas in support of international development. All of this built on world-class environmental science.

MSD

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MSD is a tradename of Merck & Co., Inc., with headquarters in Whitehouse Station, N.J., U.S.A.

MSD is an innovative, global health care leader that is committed to improving health and well-being around the world. MSD discovers, develops, manufactures, and markets vaccines, medicines, and consumer and animal health products designed to help save and improve lives.

National Physical Laboratory

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The National Physical Laboratory (NPL) is the United Kingdom's national measurement institute, an internationally respected and independent centre of excellence in research, development and knowledge transfer in measurement and materials science. For more than a century, NPL has developed and maintained the nation's primary measurement standards - the heart of an infrastructure designed to ensure accuracy, consistency and innovation in physical measurement.

Natural History Museum

The Science of Nature

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We maintain and develop the collections we care for and use them to promote the discovery, understanding, responsible use and enjoyment of the natural world.

We are part of the UK's science base as a major science infrastructure which is used by our scientists and others from across the UK and the globe working together to enhance knowledge on the diversity of the natural world.

Our value to society is vested in our research responses to challenges facing the natural world today, in engaging our visitors in the science of nature, in inspiring and training the next generation of scientists and in being a major cultural tourist destination.

NEF: The Innovation Institute

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The Innovation Institute is the leading provider of innovation and growth solutions to business, education and government. Through our strategic programmes we help our clients and stakeholders to:

- Achieve performance excellence
- Drive entrepreneurship
- Diversify products and markets
- Develop innovative cultures
- Influence policy to stimulate innovation

Our charitable arm, the New Engineering Foundation, supports vocational scientific and technical skills development at strategic level. In addition, our Institute of Innovation and Knowledge Exchange is a professional body and "do tank", led by the Innovation Council to support the role of innovation in society.

Nesta

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Nesta is the UK's innovation foundation with a mission to help people and organisations bring great ideas to life. We do this by providing investments and grants and mobilising research, networks and skills.

Nesta doesn't work alone. We rely on the strength of the partnerships we form with other innovators, community organisations, educators and investors too.

We are an independent charity and our work is enabled by an endowment from the National Lottery.

Nesta is a registered charity in England and Wales with a company number 7706036 and charity number 1144091. Registered as a charity in Scotland number SC042833. Registered office: 1 Plough Place, London, EC4A 1DE.

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PHARMAQ Ltd

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PHARMAQ is the only global pharmaceutical company with a primary focus on aquaculture. We provide environmentally sound, safe and efficacious health products to the global aquaculture industry through targeted research and the commitment of dedicated people. Our product range includes vaccines, anaesthetics, antibiotics, sea lice treatments and biocide disinfectants. We also recently acquired a diagnostics company, PHARMAQ Analytiq, which offers a range of diagnostics services that help to safeguard fish welfare and improve productivity in the global aquaculture industry.

The Physiological Society

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The Physiological Society brings together over 3000 scientists from over 60 countries. Since its foundation in 1876, our Members have made significant contributions to the understanding of biological systems and the treatment of disease. The Society promotes physiology with the public and Parliament alike, and actively engages with policy makers. It supports physiologists by organising world-class conferences and offering grants for research. It also publishes the latest developments in the field in its two leading scientific journals, The Journal of Physiology and Experimental Physiology.

Prospect

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Prospect is an independent, thriving and forward-looking trade union with 120,000 members across the private and public sectors and a diverse range of occupations. We represent scientists, technologists and other professions in the civil service, research councils and private sector.

Prospect's collective voice champions the interests of the engineering and scientific community to key opinion-formers and policy makers. With negotiating rights with over 300 employers, we seek to secure a better life at work by putting members' pay, conditions and careers first.

ROYAL ACADEMY OF ENGINEERING

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Founded in 1976, The Royal Academy of Engineering promotes the engineering and technological welfare of the country. Our activities – led by the UK's most eminent engineers – develop the links between engineering, technology, and the quality of life. As a national academy, we provide impartial advice to Government; work to secure the next generation of engineers; and provide a voice for Britain's engineering community.

Royal Botanic Gardens, Kew

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RBG Kew is a centre of global scientific expertise in plant and fungal diversity, conservation and sustainable use, housed in two world-class gardens. Kew is a non-departmental public body with exempt charitable status and receives approximately half its funding from government through Defra. Kew's Breathing Planet Programme has seven key priorities:

- Accelerating discovery and global access to plant and fungal diversity information
- Mapping and prioritising habitats most at risk
- Conserving what remains
- Sustainable local use of plants and fungi
- Banking seed from 25% of plant species in the Millennium Seed Bank Partnership
- Restoring and repairing habitats
- Inspiring through botanic gardens

Kew's mission is to inspire and deliver science-based plant conservation worldwide, enhancing the quality of life.

The Royal Institution Science Lives Here

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The core activities of the Royal Institution centre around four main themes: science education, science communication, research and heritage. It is perhaps best known for the Ri Christmas Lectures, but it also has a public events programme and an online science short-film channel, as well as a UK-wide Young People's Programme of science and mathematics enrichment activities. Internationally recognised research programmes in bio- and nanomagnetism take place in the Davy Faraday Research Laboratory.

The Royal Society

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The Royal Society is the UK academy of science comprising 1400 outstanding individuals representing the sciences, engineering and medicine. It has had a hand in some of the most innovative and life-changing discoveries in scientific history. Through its Fellowship and permanent staff, it seeks to ensure that its contribution to shaping the future of science in the UK and beyond has a deep and enduring impact.

ROYAL SOCIETY OF CHEMISTRY

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The Royal Society of Chemistry is the world's leading chemistry community, advancing excellence in the chemical sciences. With 48,000 members and a knowledge business that spans the globe, we are the UK's professional body for chemical scientists; a not-for-profit organisation with 170 years of history and an international vision of the future. We promote, support and celebrate chemistry. We work to shape the future of the chemical sciences – for the benefit of science and humanity.

Society for Applied Microbiology

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*Sf*AM is the oldest UK microbiological society and aims to advance, for the benefit of the public, the science of microbiology in its application to the environment, human and animal health, agriculture and industry.

*Sf*AM is the voice of applied microbiology with members across the globe and works in partnership with sister organisations to exert influence on policy-makers world-wide.

Society for General Microbiology

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SGM is the largest microbiological society in Europe. The Society publishes four journals of international standing, and organises regular scientific meetings.

SGM also promotes education and careers in microbiology, and it is committed to represent microbiology to government, the media and the public.

An information service on microbiological issues concerning aspects of medicine, agriculture, food safety, biotechnology and the environment is available on request.

Society of Biology

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The Society of Biology has a duty under its Royal Charter "to serve the public benefit" by advising Parliament and Government is a single unified voice for biology: advising Government and influencing policy; advancing education and professional development; supporting our members, and engaging and encouraging public interest in the life sciences. The Society represents a diverse membership of over 80,000 - including, students, practising scientists and interested non-professionals - as individuals, or through learned societies and other organisations.

Society of Chemical Industry (SCI)

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SCI is an inclusive, multi-disciplinary forum connecting scientists and business people to advance the commercial application of chemistry and related sciences for public benefit. SCI is open to all to join and share information, ideas, innovations and research. Members can network with specialists from sectors as diverse as food and bio-renewables, water, waste and environment, energy, materials, manufacturing and health.

Society of Cosmetic Scientists

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Advancing the science of cosmetics is the primary objective of the SCS. Cosmetic science covers a wide range of disciplines from organic and physical chemistry to biology and photo-biology, dermatology, microbiology, physical sciences and psychology.

Members are scientists and the SCS helps them progress their careers and the science of cosmetics ethically and responsibly. Services include publications, educational courses and scientific meetings.

Society of Maritime Industries

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The Society of Maritime Industries is the voice of the UK's maritime engineering and business sector promoting and supporting companies which design, build, refit and modernise ships, and supply equipment and services for all types of commercial and naval ships, ports and terminals infrastructure, offshore oil & gas, maritime security & safety, marine science and technology and marine renewable energy.

Universities Federation for Animal Welfare

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UFAW is an international, independent scientific and educational animal welfare charity. It works to improve animal lives by:

- supporting animal welfare research.
- educating and raising awareness of welfare issues in the UK and overseas.
- producing the leading journal Animal Welfare and other high-quality publications on animal care and welfare.
- providing expert advice to government departments and other concerned bodies.

The Welding Institute

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The Welding Institute is the leading engineering institution with expertise in solving problems in all aspects of manufacturing, fabrication and whole-life integrity management.

Personal membership provides professional development for engineers and technicians, and registration as Chartered or Incorporated Engineer, or Engineering Technician.

Industrial membership provides access to one of the world's foremost independent research and technology organisations.

TWI creates value and enhances quality of life for Members and stakeholders through engineering, materials and joining technologies.

Research Councils UK

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Each year the Research Councils invest around £3 billion in research covering the full spectrum of academic disciplines from the medical and biological sciences to astronomy, physics, chemistry and engineering, social sciences, economics, environmental sciences and the arts and humanities.

Research Councils UK is the strategic partnerships of the seven Research Councils. It aims to:

- increase the collective visibility, leadership and influence of the Research Councils for the benefit of the UK;
- lead in shaping the overall portfolio of research funded by the Research Councils to maximise the excellence and impact of UK research, and help to ensure that the UK gets the best value for money from its investment;
- ensure joined-up operations between the Research Councils to achieve its goals and improve services to the communities it sponsors and works with.

Biotechnology and Biological Sciences Research Council (BBSRC)

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BBSRC invests in world-class bioscience research and training on behalf of the UK public. Our aim is to further scientific knowledge to promote economic growth, wealth and job creation and to improve quality of life in the UK and beyond. BBSRC research is helping society to meet major challenges, including food security, green energy and healthier, longer lives and underpins important UK economic sectors, such as farming, food, industrial biotechnology and pharmaceuticals.

Economic and Social Research Council

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The ESRC is the UK's leading research and training agency addressing economic and social concerns. We pursue excellence in social science research; work to increase the impact of our research on policy and practice; and provide trained social scientists who meet the needs of users and beneficiaries, thereby contributing to the economic competitiveness of the United Kingdom, the effectiveness of public services and policy, and quality of life. The ESRC is independent, established by Royal Charter in 1965, and funded mainly by government.

EPSRC

Engineering and Physical Sciences Research Council

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EPSRC is the UK's main agency for funding research in engineering and physical sciences, investing around £800m a year in research and postgraduate training, to help the nation handle the next generation of technological change.

The areas covered range from information technology to structural engineering, and mathematics to materials science. This research forms the basis for future economic development in the UK and improvements for everyone's health, lifestyle and culture. EPSRC works alongside other Research Councils with responsibility for other areas of research.

Medical Research Council

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Over the past century, the MRC has been at the forefront of scientific discovery to improve human health. Founded in 1913 to tackle tuberculosis, the MRC now invests taxpayers' money in the highest quality medical research across every area of health. Twenty-nine MRC-funded researchers have won Nobel prizes in a wide range of disciplines, and MRC scientists have been behind such diverse discoveries as vitamins, the structure of DNA and the link between smoking and cancer, as well as achievements such as pioneering the use of randomised controlled trials, the invention of MRI scanning, and the development of therapeutic antibodies. We also work closely with the UK's Health Departments, the NHS, medical research charities and industry to ensure our research achieves maximum impact as well as being of excellent scientific quality.

Natural Environment Research Council

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The NERC invests public money in cutting-edge research, training and knowledge transfer in the environmental sciences – through Universities and our own research centres. We work from the poles to the ocean depths and to the edge of space, researching critical issues such as biodiversity loss, climate change and natural hazards. Through collaboration with other science disciplines, with UK business and with policy-makers, we deliver knowledge and skills to support sustainable economic growth and public wellbeing – reducing risks to health, infrastructure and supply chains, and the natural environment on which we all depend.

Science & Technology Facilities Council

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The Science and Technology Facilities Council is one of Europe's largest multidisciplinary research organisations supporting scientists and engineers world-wide. The Research Council operates world-class, large-scale research facilities and provides strategic advice to the UK Government on their development. The STFC partners in two of the UK's Science and Innovation Campuses. It also manages international research projects in support of a broad cross-section of the UK research community, particularly in the fields of astronomy, nuclear physics and particle physics. The Council directs, co-ordinates and funds research, education and training.

SCIENCE DIARY

THE PARLIAMENTARY AND SCIENTIFIC COMMITTEE

Tel: 020 7222 7085
annabel.lloyd@parliament.uk
www.scienceinparliament.org.uk

Tuesday 22 October
Smart Buildings
Speakers: Dr Deborah A Pullen, Group Research Director, Building Research Establishment
Professor Doug King FREng, Chief Scientific and Engineering Advisor. Building Research Establishment; Principal, Doug King Consulting Ltd, Visiting Professor, University of Bath
Dr Martyn Thomas FREng CBE, Vice-President, Royal Academy of Engineering

Tuesday 5 November
Annual Lunch
Guest of Honour: Sir Mark Walport FRS Government Chief Scientific Adviser

Tuesday 19 November
A Good Immigration Policy for Science

Tuesday 10 December
Deep Sea Mining to include Protection of the Seabed

Tuesday 21 January 2014
Badgers

Tuesday 25 February
Biodiversity: Natural Capital Initiative

THE ROYAL SOCIETY

Website: royalsociety.org

The Royal Society hosts a series of free events, including evening lectures and conferences, covering the whole breadth of science, engineering and technology for public, policy and scientific audiences. Events are held at the Royal Society's offices in London, at the Royal Society at Chicheley Hall, home of the Kavli Royal Society International Centre, Buckinghamshire and other venues.
Many past events are available to watch or listen to online at http://royalsociety.tv The collection includes events with speakers such as Jocelyn Bell Burnell FRS, Val McDermid and Professor Brian Cox OBE. Details of all our events can be found on our website at royalsociety.org/events

THE ROYAL INSTITUTION

21 Albemarle Street
London W1S 4BS.

Details of future events can be found at www.rigb.org
Booking is essential. For more information and to book visit www.rigb.org
There is a charge for tickets. Members go free.

PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY

For details of events organised by POST visit http://www.parliament.uk/mps-lords-and-offices/offices/bicameral/post/post-events/

THE INSTITUTION OF MECHANICAL ENGINEERS

The Institution of Mechanical Engineers plays a leading role in the international engineering community in providing advice to governments, industry and global society. Each year it organises some 300 technical conferences, seminars, lectures, debates and workshops around the UK and internationally, on key updates, developments or new techniques across 18 engineering and manufacturing sectors.

For details visit: www.imeche.org/events

THE LINNEAN SOCIETY OF LONDON

The Linnean Society, in Piccadilly, has a diverse programme of evening lectures and day meetings covering the natural world, encompassing science, history and art. Most meetings are open to the public and many are free. Please subscribe to our free email-based newsletter - *Linnean-News* or visit our website www.linnean.org where you will find full programme details and registration forms.

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BIVDA

The value of diagnostics:

Using IVD's can make a difference in reducing antibiotic resistance

Seventy percent of clinical decisions are based on an *in vitro* diagnostic (IVD) test. These have an increasing role to play to deliver cost effective healthcare and improve outcomes for patients.

The use of IVDs can significantly support the reduction of antibiotic resistance by:

- Supporting antibiotic stewardship
- Differentiating between bacterial and viral infection
- Rapidly identifying cause of infection to allow targeted antibiotic usage
- Monitoring infection levels during treatment

About BIVDA

BIVDA is the national industry association for the manufacturers and distributors of IVD products in the UK. We currently represent more than 90% of the industry and over a hundred organisations ranging from British start-up companies to UK subsidiaries of multinational corporations. BIVDA members employ over 8,000 people in this country including in manufacturing and R&D, with a total industry turnover of approximately £900 million of direct sales.

Please don't hesitate to contact the Chief Executive, Doris-Ann Williams if you would like any further information about any of the aspects of this issue or about *in vitro* diagnostics in general. She is always more than willing to visit you in Westminster.

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FIS 2013

Annual Conference
11 - 13th November, Birmingham
www.actiononinfection.com

Federation of Infection Societies (FIS) supports

EUROPEAN ANTIBIOTIC AWARENESS DAY

Promoting appropriate use of ANTIBIOTICS to preserve their effectiveness now and in the future

Support European Antibiotic Awareness Day

Resources available at antibiotic.ecdc.europa.eu

EUROPEAN ANTIBIOTIC AWARENESS DAY

A European Health Initiative

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- Society for General Microbiology
- Clinical Virology Network
- UKCPA Infection Management Group
- Infection Prevention Society
- Welsh Microbiological Association
- The Children's HIV Association
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- British Society for Medical Mycology
- British Paediatric Allergy, Immunology & Infection Group
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- The Royal Society of Tropical Medicine and Hygeine
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BSAC The British Society for Antimicrobial Chemotherapy
www.bsac.org

ANTIBIOTIC ACTION
www.antibiotic-action.com

For further information on BSAC and the FIS initiative, contact Tracy Guise CEO, BSAC on +44 (0)121 236 1988 or email TGuise@bsac.org.uk