



# **Tracing the impacts of public dialogue projects supported by Sciencewise:**

## **Synthetic biology**

**March 2016**

## Synthetic Biology

### Key facts

#### Date

July 2009 - April 2011 (21 months)

#### Costs

- Total cost of project: £334,000
- Sciencewise funding: £234,000

#### Commissioned by

Biotechnology and Biological Sciences Research Council (BBSRC) and Engineering and Physical Sciences Research Council (EPSRC)

#### Delivery

TNS BMRB

#### Evaluation

Laura Grant Associates

#### Sciencewise Dialogue and Engagement Specialist (DES)

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### Introduction

This public dialogue project was established by two Research Councils (BBSRC and EPSRC) to engage the public and others in this emerging area of science, to help to begin to determine the future direction of research in this area. The project received high level support within the two Research Councils from the beginning, as all involved recognised early that the results of the dialogue would resonate beyond the immediate topic and those involved. The dialogue results were highly influential both in future plans for research and investment in synthetic biology in the UK, and in the development of the concept of responsible research and innovation. Indeed:

*"Public participants were surprised at the perceived lack of scrutiny other than by scientific experts in how science is funded, and that the social implications and ethical issues were not considered as strictly as they thought they should be. It is those insights around how the funding and innovation system works as much as synthetic biology and the technology itself which have been particularly interesting and influential." (BBSRC 2016).*

### The dialogue project in summary

Synthetic biology uses developments in engineering and bioscience to create new biological parts or to redesign existing ones for potential uses including in food and biofuels, drugs and diagnostics, bioremediation and biosensors. Although still in its infancy at the time, synthetic biology was seen to potentially significantly affect people's lives in future, and still has major ethical and social issues.

By 2007, there was already significant activity around synthetic biology. The Royal Academy of Engineering (RAEng) set up an inquiry into synthetic biology which recommended public engagement, and then undertook an exploratory public dialogue exercise (the results of which were published in June 2009<sup>1</sup>). The Royal Society set up an expert synthetic biology policy co-ordination group in 2007. Also in 2007, BBSRC Bioscience for Society Strategy Panel (BSS) set up a working group to consider this new area of science. The BSS commissioned an independent report called *Synthetic Biology: Social and Ethical Challenges*, published in May 2008.

In the UK, the development of synthetic biology was seen in the context of GM crops, "*where lack of public trust has halted entire technologies*": the GM debate took place in 2002-3. The Synthetic Biology dialogue project was considered to be "*on much firmer ground*" than other more criticised activities<sup>2</sup>.

In January 2008, a Note was published by the Parliamentary Office for Science and Technology (POST) on synthetic biology which concluded that "*There is concern that the research should be developed with a global, open dialogue about the scientific, social, economic and ethical implications*". By 2009, synthetic biology research was starting to develop, and BBSRC were funding the Synthetic Biology network of researchers. The planning for the BBSRC / EPSRC public dialogue project started in detail early in 2009; a similar dialogue was being undertaken in Germany.

The public dialogue project, supported by Sciencewise, was extensive. The stated aim of the public dialogue project was "*To allow the diverse perspectives of a range of UK residents to be articulated clearly and in public in order that future policies can better reflect these views, concerns and aspirations.*"

<sup>1</sup> [www.raeng.org.uk/synbiodialogue](http://www.raeng.org.uk/synbiodialogue)

<sup>2</sup> Both quotes from Colin Macilwain (2010) 'Talking the Talk: Without effective public engagement, there will be no synthetic biology in Europe', *NATURE* 465, 867 ((2010)

The main elements of the project were:

- Significant high level involvement from the start, with early commitment from the BBSRC and EPSRC Chief Executive Officers (CEOs) to the dialogue process, including to ensure the dialogue results were disseminated to a broad spectrum of policy makers. Commitment from these senior people continued throughout and after the dialogue events.
- A Steering Group (with 11 stakeholders) and an Oversight Group (with 18 stakeholders) were established, with diverse perspectives from policy makers, funders, scientists, social scientists, NGOs and learned societies. These two groups oversaw the process, including reviewing the materials to be used in the public workshops. The Oversight Group included the RAEng and Royal Society, to ensure links to the earlier and continuing activities on synthetic biology.
- A series of in depth telephone interviews was conducted with 41 stakeholders to understand some of the technical, social and economic drivers shaping synthetic biology in the UK. The results of these interviews informed the framing and content of the public dialogue.
- A total of 160 public participants in four locations were involved, recruited on the basis of demographic criteria (e.g. age, gender) and also based on their attitudes to the environment and their level of community engagement.
- The four groups of public participants were brought together three times in deliberative workshops in London, Llandudno, Newcastle-upon-Tyne and Edinburgh. The workshops also involved scientists, social scientists and representatives from the Research Councils.
- A final workshop brought back together two participants from each location (eight in total) with BBSRC, EPSRC and the delivery contractors to ensure that the findings summarised in the final dialogue report reflected what the participants themselves felt had been discussed.

The key findings<sup>3</sup> from the dialogue showed there was conditional public support for synthetic biology: while there was great enthusiasm for the possibilities of the science, there were also fears about control; who benefits; health and environmental impacts; misuse; and regulation. Five central questions emerged around taking synthetic biology forward:

- What is the purpose?
- Why do you want to do it?
- What are you going to gain from it?
- What else is it going to do?
- How do you know you are right?

Beyond the five overarching questions, six themes emerged from the public dialogue:

- **The technology.** There was public unease around living entities which were both synthetic and biological. These were seen to have less intrinsic value than those considered natural. Concerns were also raised about treating nature as 'just' parts to be assembled and the potential industrial scale of synthetic biology applications
- **Leadership and funding.** Participants wanted scope to feed public aspirations and concerns into research funding at an early stage
- **Responsibility.** Participants felt it should be incumbent on scientists to consider the five questions noted above, particularly around motivations and outcomes
- **Innovation.** There was felt to be a need for an alternative to the 'pipeline' model of innovation where ideas are created in a laboratory, embedded in products and distributed to consumers. The public should be involved throughout, not just at the end
- **Regulation.** Robust and independent regulation was seen to be key. The public did not trust a voluntary or self-regulation system particularly in relation to dealing with novel organisms
- **Future.** There were public concerns that their input would be ignored. Research Councils had a duty to continue engaging with participants and explain how some of the conditions the public had placed on the research had been met.

#### Dissemination of dialogue results

- **June 2010.** The project report was published on the BBSRC, EPSRC and Sciencewise websites in June 2010, and launched at an event in London. In addition, the Research Councils distributed hard copies to over 200 stakeholders including policy makers, academia and non-governmental organisations (NGOs). A user-friendly summary of the report was published on the websites, and hard copies circulated to the Synthetic Biology Networks among others. An interim evaluation report was published in July 2010; a follow-up evaluation report was published in April 2011.

<sup>3</sup> Text on key findings from Sciencewise case study

- **October 2010.** The CEOs of BBSRC and EPSRC met in October 2010 to discuss the dialogue results, and a letter stating their planned response was immediately sent to participants and stakeholders.
- **October 2010.** Letters were exchanged between Professor David Delpy (Chief Executive of EPSRC) and Professor John Beddington (the Government's Chief Scientific Adviser), from 15 October 2010, outlining the public concerns around regulatory frameworks raised during the dialogue and which were beyond the remit of the Research Councils.
- **10 February 2011.** An embedding workshop was held by BBSRC, EPSRC and Sciencewise in Bristol on 10th February 2011 to enable the wider synthetic biology community to discuss the dialogue results. The aim of the workshop was to further explore the messages from the dialogue, share best practice in public engagement with synthetic biology and begin to develop an action plan to embed dialogue into the business of synthetic biology research. It was attended by around 40 participants including scientists, engineers, social scientists, public engagement specialists, designers and artists.
- **From 2011.** The results of the synthetic biology dialogue continued to be disseminated by BBSRC and EPSRC, including:
  - BBSRC presentation to the Six Academies Symposium, China, October 2011
  - European Commission, Brussels, 2011 and the Hague, 2012. A number of other groups were known to be planning their own dialogues including SynBERC in the US, Germany and France. A request for the dialogue report was made by the French National Assembly.
  - ERASynBio First Strategic Conference, Switzerland, 2013
  - BBSRC and EPSRC provided advice to the Lawrence Berkeley National Laboratory and UC Berkeley as they engage the public around a new laboratory facility for synthetic biology; SynBERC in the UK; and the Observatoire de la biologie de synthèse in France<sup>4</sup>.
 The dialogue was also featured in the European Science Foundation publication in June 2012 *Science in Society: a Challenging Frontier for Science Policy*<sup>5</sup>.

## Impacts on policy

### Impacts on UK Government policy

- **7 December 2010.** The Parliamentary and Scientific Committee held a meeting focused on the dialogue (Synthetic Biology Dialogue - A Public Perspective) which was held in Westminster on 7th December 2010. Speakers included Professor Robert Winston, Dr Brian Johnson (chair of the dialogue oversight group), Professor Douglas Kell (BBSRC Chief Executive) and Professor David Delpy (EPSRC Chief Executive).
- **June 2011.** The dialogue reports and follow up were acknowledged in the Government response in June 2011 to the House of Commons Science and Technology Committee report on bioengineering. That response included that: "**18. We are pleased to discover that public engagement has been considered an early priority by those working in synthetic biology research and policy. This commitment indicates that lessons are being learned from past experiences (Paragraph 92). Government recognises the importance of considering public engagement upstream in the research process, especially in potentially controversial issues such as synthetic biology. In relation to this, the Biotechnology and Biological Sciences Research Council (BBSRC) and the Engineering and Physical Sciences Research Council (EPSRC) published their dialogue report on synthetic biology on 14 June 2010. The EPSRC and BBSRC have subsequently written an open letter to all dialogue participants outlining how they will address the issues raised in the dialogue report.**"<sup>6</sup>
- **October 2011.** The dialogue report was discussed at a round table meeting chaired by the Secretary of State, and Minister, for Business, Innovation and Skills in October 2011; the round table was the precursor to the Synthetic Biology Roadmap (see below). The Secretary of State described the dialogue as a success, and the Minister of State for Science and Universities at the time, David Willetts, concluded that "*The Government does believe that structured public dialogue on some of the big ethical challenges in science is important ... These dialogues raise very legitimate questions about how far and how fast we go with science*".

<sup>4</sup> Observatoire de la biologie de synthèse: <http://biologie-synthese.cnam.fr/>

<sup>5</sup> European Science Foundation publication 'Science in Society: a Challenging Frontier for Science Policy' June 2012.

[http://www.esf.org/index.php?eID=tx\\_ccdamdl\\_file&p\[file\]=40454&p\[dl\]=1&p\[pid\]=6766&p\[site\]=European%20Science%20Foundation&p\[t\]=1367497328&hash=ee19675217d12cdb113c3ec8eba8b2a8&l=en](http://www.esf.org/index.php?eID=tx_ccdamdl_file&p[file]=40454&p[dl]=1&p[pid]=6766&p[site]=European%20Science%20Foundation&p[t]=1367497328&hash=ee19675217d12cdb113c3ec8eba8b2a8&l=en)

<sup>6</sup> Government response to the House of Commons Select Committee on Science and Technology report on Bioengineering. Committee report published March 2010; response published in June 2011.

<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmsctech/1138/113804.htm>

- **Early 2012.** The dialogue fed into BBSRC discussions with the Technology Strategy Board (TSB)<sup>7</sup> on the ethical, social and regulatory elements of the TSB commercialisation of research findings competition on synthetic biology in 2012, the TSB Response to Innovation framework, and the Synthetic Biology Roadmap.
- **July 2012.** The plans for the development of the sector were spelt out in the *Synthetic Biology Roadmap for the UK*, published by the TSB in July 2012. The dialogue influenced the topics covered (e.g. governance) and informed the broad make up of the UK Synthetic Biology Roadmap Co-ordination Group - the independent panel of experts that produced the Roadmap report. The dialogue is cited fully in the Roadmap, and is featured as a case study.

The Roadmap was the basis for many investment decisions around synthetic biology, with priorities reflecting many of the findings of the public dialogue. The Roadmap proposed that the sector should be developed to be of clear public benefit, and that future development should include facilitating increased levels of interaction between the research community and other stakeholders including the public. A Governance and Engagement sub-group was established to maintain oversight of the continuing role of engagement in future.

- **9 November 2012.** In a speech to the Royal Society, the Chancellor of the Exchequer announced plans for Government investment in eight future technologies in the UK<sup>8</sup> "*where we already have an edge, but we could be world leading*". The second of the eight future technologies was synthetic biology. The Chancellor pointed out that the value of the global synthetic biology market was predicted to grow to £11 billion by 2016, and announced that BBSRC would be investing £20 million into leading universities and researchers in the UK to use synthetic biology to benefit the UK economy by addressing major global challenges.

Feedback from the Research Councils was that they "*can't link that directly to the public dialogue but we wouldn't have had the confidence to move forward on syn bio without the dialogue*" (BBSRC). They concluded that: "*The immediate economic benefits were very obvious. The Government stepped up funding for syn bio significantly. The public dialogue had an effect on David Willetts and the Treasury and there was a strong political shift towards this kind of policy area. So it had an impact on the progress and pace of work*" (Oversight Group)

- **November 2013.** The dialogue results also fed into TSB work on Advancing the Industrial Application of Synthetic Biology (with EPSRC), with funding of up to £500,000 for collaborative business-led projects designed to help address the challenges of commercialisation. TSB accepted the value of Responsible Innovation (see below), as called for in the Roadmap (based on the dialogue results), including amending the competition application form to require appraisals of potential social, ethical, legal, regulatory and environmental issues (EPSRC).

On 25 November 2013, TSB announced that they, with BBSRC, EPSRC and the Welsh Government, were making up to £3.8 million available to collaborative, business-led projects to develop innovative standard tools and services to help the emerging synthetic biology sector move towards full commercialisation. Projects were expected to range from £100,000 to £350,000.

- **24 February 2016.** The Minister for Life Sciences George Freeman MP launched the UK Synthetic Biology Strategic Plan 2016 – *Biodesign for the Bioeconomy*. The Strategy builds directly on the Synthetic Biology Roadmap for the UK, published in 2012, which in turn drew extensively on the Synthetic Biology public dialogue.

The Innovate UK announcement of the new Strategy<sup>9</sup> states that "*The roadmap led directly to major funding and policy activities, including the establishment of new synthetic biology research centres, the Innovation and Knowledge Centre at SynbiCITE, DNA synthesis facilities, training centres and a seed fund for innovative companies. In addition, the Synthetic Biology Leadership Council (SBLC) was founded to manage the continued growth of this field.*"

The 2016 Strategic Plan, published by the Synthetic Biology Leadership Council (SBLC), aims to accelerate the commercialisation of synthetic biology products and services with clear public benefit, building upon the strength of the UK research base. It focuses on five key areas of strategic importance:

- Accelerating industrialisation and commercialisation
- Maximising the capability of the innovation pipeline
- Building an expert workforce
- Developing a supportive business environment, and
- Building value from national and international partnerships.

<sup>7</sup> The Technology Strategy Board (TSB) is now known as Innovate UK.

<sup>8</sup> <https://www.gov.uk/government/speeches/speech-by-the-chancellor-of-the-exchequer-rt-hon-george-osborne-mp-to-the-royal-society>

<sup>9</sup> *Biodesign for the Bioeconomy. UK Synthetic Biology Strategic Plan 2016*. Innovate UK, February 2016.

<https://connect.innovateuk.org/web/synthetic-biology-special-interest-group/2016-uk-synbio-strategic-plan>

There are numerous connections between the 2016 Strategy and the original public dialogue. One of the six key themes from the public dialogue was around public engagement being continued and being influential. The new Strategy, under the fourth key area, states:

*“Develop a supportive business environment ... The application of excellent basic science at industrial scale will require an agile, supportive and proportionate governance approach, including government policies, development of standards, regulatory systems and **public and stakeholder engagement and dialogue.**”* (page 22; emphasis added)

Another of the six key themes from the public dialogue was the need for ‘Responsibility’. Participants felt it should be incumbent on scientists to consider the five central questions noted above, particularly around motivations and outcomes. These five questions contributed to the development, initially in BBSRC and EPSRC, of the concept of responsible innovation. The 2016 Strategy states that:

*“An important component of future governance of synthetic biology will be implementing responsible research and innovation (RRI). RRI includes aspects of anticipation, reflection and engagement. ... The aim should be for broad awareness and mutual understanding of synthetic biology across public and stakeholder groups, and for research and innovation communities to build public trust through being open about their motivations and aims.”*

*“UK Research Councils, Innovate UK and EC research programmes are considering how best to conduct public engagement as part of a RRI approach, The SBLC will take an active part in these developments. There is a generally perceived need to ensure that all key actors, including policy makers, regulators and civil society, as well as researchers and innovators, are aware of the broader implications of their actions and understand what acting responsibly would mean for them.”* (page 23)

#### Impacts on Responsible Research and Innovation

The five questions raised by the participants about motivations for the research and its potential implications (see above) were found to be especially important. These contributed to the developing concept of ‘responsible innovation’ by the BBSRC Bioscience in Society Panel and the EPSRC Societal Issues Panel.

*“The thing I took away [from the synthetic biology dialogue], and we as an organisation, was that while there were messages clearly related to synthetic biology, there were broader messages around how research is funded and conducted in a responsible way. It’s well documented that as a result we began to develop a process around responsible innovation, and are still developing it”* (EPSRC)

Responsible innovation has become widespread in BBSRC, EPSRC and other work, aiming to ensure science proceeds in a pragmatic and responsible way.

- **January 2011.** EPSRC continued to pursue the regulatory aspects and work around responsible innovation, and a joint EPSRC / ESRC £60,000 project was announced for a six-month scoping project by Professor Richard Owen Professor of Science and Innovation Governance at University of Exeter Business School and others. In January 2011, EPSRC Chief Executive Office Dave Delpy signalled EPSRC’s intention to develop the responsible innovation framework, stating: *“The public rightly expect to be able to trust funders to ensure that scientists think about the potential impacts of their research and act responsibly...The researchers we fund should form the first link in an anticipatory and adaptive governance partnership”*<sup>10</sup>.

Owen describes how the EPSRC drew on earlier dialogues on nanosciences research (2008) and how *“Concepts of participatory agenda setting leading to concrete actions would later be reflected in two key dimensions of the RI framework – inclusive deliberation and responsiveness – and the articulation of a key question – ‘what kind of future do we want science and innovation to bring into the world’”*<sup>11</sup>. The findings from the Synthetic Biology dialogue fed directly into this work. The EPSRC’s Special Interest Group considered how responsible innovation could be pursued further at the EPSRC. Owen goes on to say:

*“The second of these meetings also considered the findings of a public dialogue on synthetic biology (TNS-BMRB 2010) that highlighted a clear desire by the public for scientists to take more responsibility for thinking about the implications of their research, and for research councils to take responsibility to consider the wider dimensions of the research they fund: to ‘re-imagine the whole process of funding’. These findings provided additional impetus for the development of a more generic RI Framework”*

<sup>10</sup> Delpy, D. 2011. ‘Synthetic Biology Public Dialogue.’ *Science in Parliament* (Journal of the Parliamentary Scientific Committee) 68 (1): 43. <http://www.vmine.net/scienceinparliament/sip68-1.pdf>

<sup>11</sup> Owen, R 2014. ‘The UK Engineering and Physical Sciences Research Council’s commitment to a framework for responsible innovation.’ *Journal of Responsible Innovation*, Vol 1, issue 1, 2014. <http://www.tandfonline.com/doi/abs/10.1080/23299460.2014.882065>

- **October 2012.** Building on the scoping study funded in conjunction with ESRC, a paper was presented to EPSRC Council in October 2012 which set out a strategy for implementing and embedding an approach to responsible innovation. The approach was endorsed by Council. EPSRC report that the new focus on Responsible Innovation would not have happened so quickly or so deeply without the dialogue.

The concept of responsible innovation has been followed up elsewhere<sup>12</sup>:

*"Responsible innovation is a collective commitment of care for the future through responsive stewardship of science and innovation in the present"* (page 36, Owen et al 2013). *"It has four elements: it is anticipatory (considering impacts that might arise); reflective (considering underlying purposes, motivations, uncertainties, risks, assumptions, questions); deliberative (opening up to deliberation through dialogue, inviting and listening to perspectives from publics and diverse stakeholders); responsive (with the pace and direction of innovation set through effective mechanisms of participatory and anticipatory governance)"* (p37, *ibid*). The development of the concept has been partly driven by *"the desire to ensure that the 'mistakes of GM were not repeated again'"* (p40, *ibid*).

- **2013.** The Responsible Innovation Framework was launched on the EPSRC website in 2013<sup>13</sup>. EPSRC is "committed to develop and promote Responsible Innovation ... As a public funder of research, we have a responsibility to ensure that our activities and the research we fund, are aligned with the principles of Responsible Innovation, creating value for society in an ethical and responsible way.
- **February 2016.** BBSRC continues to see the direct links between the synthetic biology dialogue and the development of what is now called Responsible Research and Innovation (RRI): *"There has been a lot of thinking amongst research councils about responsible innovation. I think the synthetic biology dialogue along with others that Sciencewise funded has helped us to develop our approach and thinking around what responsible research and innovation looks like, so it is definitely a piece in the jigsaw behind that."* (BBSRC)

*"One of the key findings from the dialogue was around the surprise that people had about us not paying as much attention as perhaps they thought we should to the broader issues around research across all science funding. So that's fed through to our thinking. The dialogue came up with five questions that the public wanted researchers to ask themselves as they got out of bed every morning ... those five questions have definitely informed how we thought about other technologies and other funding. So I think there are lots of little strands that flow out of the public dialogue and have definitely influenced our thinking.... we worked together with EPSRC on the public dialogue and they took forward a really valuable piece of work around responsible innovation as a direct result of the public dialogue. That is a very clear and direct impact of the dialogue. And that's now embedded across EPSRC's funding and also BBSRC's."* (BBSRC)

#### Impacts on other policy and funding activities

- **2010.** A US House of Representatives report on *Engineering the Climate*<sup>14</sup> refers to the dialogue project directly in the report as follows: *"Challenges in Europe. There are lessons to be learned from the European experience with the still-nascent field of synthetic biology. The potential applications of synthetic biology, including its capacity to modify the genetic makeup of food crops to increase crop yields and provide greater pest resistance have been met with uncertainty. Public confusion about governmental motivations for agricultural biotechnology led to a virtual moratorium on genetically modified (GM) foods. Having learned from these challenges, both German and British national research councils have recently committed to a thorough public dialogue regarding synthetic biology as they seek to jump start development in the field. A number of unresolved questions on the ethical and environmental implications of synthetic biology remain, and international standards are minimal or non-existent. Better public engagement in Europe is seen as a fundamental step in the development of this field."* The example refers to the article by Colin Macilwain, 'Talking the Talk: Without Effective Public Engagement, There Will Be No Synthetic Biology in Europe', 465 *NATURE* p.867 (2010).
- **2011. Joint Synthetic Biology Initiative (JSBI).** The dialogue influenced the scope, tone and content of the JSBI which was set up in 2011 and made £2.4 million<sup>15</sup> available from BBSRC, EPSRC, the Medical Research Council and others; activities included a workshop to help researchers explore the social and ethical dimensions of their work. The initial invitation included a direct link to the public dialogue report.

<sup>12</sup> 'A Framework for Responsible Innovation' by Owen, R; Stilgoe, J., Macnaghten, P., Gorman, M., Fisher, E., Guston, D., in *Responsible Innovation. Managing the Responsible Emergence of Science and Innovation in Society* (2013) by Owen, R., Bessant, J. and Heintz, M. (eds). <http://www.tandfonline.com/doi/pdf/10.1080/23299460.2014.882065>

<sup>13</sup> <https://www.epsrc.ac.uk/research/framework/> (accessed 29 February 2016)

<sup>14</sup> *Engineering the Climate: Research needs and strategies for international co-ordination.* Report by Chairman Bart Gordon, Committee on Science and Technology, US House of Representatives (p12). Available online: <http://www.science.house.gov>

<sup>15</sup> <https://www.epsrc.ac.uk/funding/calls/jointsyntheticbiologyinitiative/>

- **May 2013.** The first call for research projects in synthetic biology to be supported by international investment through ERASynBio<sup>16</sup> was launched, with a deadline of 26 August 2013. A permanent public dialogue element was included in ERASynBio, running for three years from January 2012; a workshop had been held in March 2013 to discuss public dialogue in relation to the first call through this ERANet programme.

ERASynBio is the ERANet in Synthetic Biology - ERASynBio. 12 funding agencies, including BBSRC, took part; eight proposals were selected for funding of more than €13 million, bringing together researchers from Europe and the US. This was a part of the commitment towards the UK building its leading international role in synthetic biology as recommended in the Roadmap (BBSRC Press Release, 2013). Bids were required to carefully outline the ethical, societal and regulatory implications, and the call directly references the dialogue project. The ethics guidance for the call included a section on public involvement and science-society dialogue under Legal, Governance and Policy aspects.

- **6 June 2013.** BBSRC held an information workshop on the six Multidisciplinary Synthetic Biology Research Centres being set up<sup>17</sup>. Each centre was to run for up to five years (three starting in 2013 and three in 2014), with funding of around £15 million each - a total of £40 million spend in 2013 and the same in 2014. Funding was announced in June 2013.

The dialogue fed into and directly influenced all EPSRC calls around synthetic biology activity. The dialogue was directly referenced in the reference file for calls to establish six multi-disciplinary synthetic biology research centres over two years, co-funded by BBSRC and EPSRC, and is shown as a related link on all web pages related to the centres. The reference file directly cites the five questions that arose from the dialogue for scientists to answer.

Research centres, including through the Synthetic Biology Networks<sup>18</sup>, were encouraged to develop and share public engagement tools as part of their funded activities. The final reports from the Synthetic Biology Networks show that the networks were engaged with the dialogue both in terms of participating in it and awareness of the findings.

- **October 2013.** The influence of the Synthetic Biology dialogue on the opening up of the synthetic biology field was described in a paper in the Science and Public Policy journal<sup>19</sup>. The authors state that: *"Within the governance of SB [synthetic biology] there has been a manifest will to engage publics and social scientists within this 'new' innovation system as it emerges and develops. The major report titled 'Synthetic Biology Dialogue' (Biotechnology and Biological Sciences Research Council, Engineering and Physical Sciences Research Council and Sciencewise (2010), is regularly drawn on by various actors within science and governance in their articulation of how SB is being regulated. For example, they often use this report as evidence that SB is taking public actors' views into consideration and that synthetic biologists are actively interested in how public actors think about SB. In this regard, public actors are regularly conceptualised as being significantly engaged in shaping technoscience. SB, at least in governance discourse, appears to be opening itself up."*
- **November 2014.** The Government's Chief Scientific Adviser published his 2014 Annual Report<sup>20</sup> – *Innovation: Managing Risk, Not Avoiding It*. This report includes a case study on synthetic biology within the chapter on Public Risk Management in Government, which makes direct reference to the public dialogue. The case study points out that *"the commercialization of effective solutions depends not only on technological feasibility, but also on their affordability and their social acceptability"* (p44). The case study goes on to say *"Taking a long-term view of the future provides a structured opportunity to anticipate risks and associated issues, and also gives more time to reflect upon and address them.... In addition to the ongoing process of review by regulatory bodies, numerous other checks and balances have been put in place. The Synthetic Biology Public Dialogue, for example, provided an opportunity to engage a wide range of stakeholders outside the scientific community, identifying concerns and viewpoints that have helped to shape current responses."* (p45)

### Impacts on BBSRC, EPSRC and others

The public dialogue has influenced how BBSRC, EPSRC and others work in a variety of other specific ways including the following (in addition to the impacts on Responsible Research and Innovation and on wider funding and investment as outlined above). Internal impacts include:

<sup>16</sup> [www.erasynbio.eu/index.php?index=17](http://www.erasynbio.eu/index.php?index=17).

<sup>17</sup> [www.bbsrc.ac.uk/web/FILES/Workshops/1306-sbrc-information-workshop.pdf](http://www.bbsrc.ac.uk/web/FILES/Workshops/1306-sbrc-information-workshop.pdf)

<sup>18</sup> <https://connect.innovateuk.org/web/synthetic-biology-special-interest-group/other-networks>

<sup>19</sup> Molyneux-Hodgson, Susan and Balmer, Andrew S. 'Synthetic biology, water industry and the performance of an innovation barrier'. *Science and Public Policy* (2013) doi: 10.1093/scipol/sct074 First published online: October 17, 2013. Full text available at: <http://spp.oxfordjournals.org/content/early/2013/10/17/scipol.sct074.full.pdf+html>

<sup>20</sup> Annual Report of the Government Chief Scientific Adviser 2014. *Innovation: Managing Risk, Not Avoiding It*. November 2014. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/381906/14-1190b-innovation-managing-risk-evidence.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/381906/14-1190b-innovation-managing-risk-evidence.pdf)



- **BBSRC Strategy.** BBSRC increasingly built public engagement and dialogue into its decision making systems since the Synthetic Biology dialogue and other dialogue projects (sometimes co-funded by Sciencewise). Public dialogue and engagement is now "a vital part of BBSRC's strategy which recognises that the full impact of bioscience will not be realised unless society is engaged. Actively undertaking public engagement activities and being responsive to public views about research and practice is instrumental to BBSRC as a publicly funded body. It is right not only for BBSRC to tell people about how it invests public money, but also to give them the opportunity to influence how it is invested in bioscience. UK bioscience benefits from a great deal of public and political support, and is trusted to deliver benefits for society, as well as the UK economy. By being open and transparent, allowing the public a voice in decision making allows BBSRC to help maintain this trust." (BBSRC statement on public engagement as part of its 20th anniversary series, May 2014).
- **BBSRC grant application processes.** BBSRC reviewed how it asks its research community to consider its research in a wider context and has introduced new measures to encourage thoughtfulness and reflection as part of its ethical and social issues monitoring processes. All applicants will now consider ethical and social issues when they are applying for grant funding, rather than later in the process. Clearer guidance has been developed to help applicants explore the full range of possible issues. Adjustments were made "in direct response to participant feedback" in the synthetic biology dialogue<sup>21</sup>. (BBSRC).
- **New BBSRC public dialogues.** BBSRC has engaged with the public since its formation in 1994, when it was involved in the first consensus conference on plant biotechnology. Since then, BBSRC has run 14 dialogues and continues to develop the mechanisms by which public views are incorporated into policymaking and strategy.

Since the original synthetic biology dialogue, BBSRC has run the distributed Bioenergy Dialogue<sup>22</sup> (again with Sciencewise support), as well as dialogues with several BBSRC research institutes (see below).

In February 2016, BBSRC saw their work on dialogue continuing to develop: "the process of how to do dialogue has evolved at BBSRC quite a lot. We make, we continue to do quite a lot of public dialogue so having the synthetic biology dialogue as an exemplar case of what can happen when public dialogue works well in our view, has helped embed public dialogue as a valuable tool within the organisation." (BBSRC)

- **BBSRC Training.** BBSRC developed a public engagement training course, open to all BBSRC-funded researchers, which includes elements focussing specifically on social and ethical dimensions of research. The training helps develop awareness within the research community of the social and ethical issues that their work raises and encourage engagement with the public with those topics. It draws directly on the Synthetic Biology dialogue, for instance by featuring the 'five questions' from the dialogue report. This continues in 2016.
- **Work with BBSRC research institutes.** BBSRC decisions about strategic investment in the eight research institutes it funds are based on an Interim Assessment Exercise. One of the five key areas assessed is the achievements in, and plans for, public engagement. In recent years, BBSRC has encouraged its research institutes to change their approach to public engagement to be more dialogue-driven. This approach fed into the development of a number of dialogues, supported by Sciencewise, by research centres supported by BBSRC: Rothamsted Research<sup>23</sup>, Babraham Institute<sup>24</sup> and John Innes Centre<sup>25</sup>.
- **Learning for research and research councils.** Those involved report wider impacts on the way research is approached, as a result of the dialogue:

*"It confirmed the public are more than able to engage with complex science" (BBSRC)*

*"The most important findings was that there was not outright opposition to the concept of synthetic biology, and that there was a degree of enthusiasm for the science, with caveats. And they were that it should be done safely, and that the scientists themselves should think about the consequences of their work and how to communicate it with the public ... I think the research councils and peer review committees now think more deeply about the safety of these projects ... There are now specific requirements for researchers to think about the consequences and how they will communicate with the public" (Oversight Group)*

- In late summer 2015, BBSRC worked with Forum for the Future and Friends of the Earth to produce a deliberation tool to help researchers, companies and others to think about synthetic biology in the round – the technological issues, global justice issues, health, biodiversity and unintended consequences.

<sup>21</sup> From BBSRC's *Synthetic Biology Dialogue - Impacts* report, May 2013

<sup>22</sup> <http://www.bbsrc.ac.uk/engagement/dialogue/activities/bioenergy-dialogue/>

<sup>23</sup> <http://www.rothamsted.ac.uk/news/public-dialogue-guiding-principles-rothamsted-research%E2%80%99s-work-with-industry>

<sup>24</sup> <http://www.babraham.ac.uk/get-involved/partnerships-page/public-dialogue/final-report>

<sup>25</sup> <https://www.jic.ac.uk/reflecting-public-views/>

BBSRC felt that *“the fact that we had done the public dialogue gave BBSRC a good standing to reach out to someone like Friends of the Earth who is not a natural partner for us; facilitated by Forum for the Future. It was a really useful and meaningful partnership.”* (BBSRC)

- **February 2016.** BBSRC continues to see the impacts of the dialogue in research investment: *“the fact that Sciencewise supported BBSRC and EPSRC to do the dialogue very early on very upstream has meant that without a doubt some of that public voice has made it through. You can certainly trace it backwards from where we are today. I don’t think that would have happened without the public dialogue. BBSRC and EPSRC and other research councils have invested close to £100 million into the six synthetic biology research centres for instance. Integral to those synthetic biology research centres is an expectation that researchers do their research in a responsible way, which includes thinking about the broader issues that the dialogue raised and public engagement and stakeholder engagement. So definitely the thread of the dialogue can be felt in those kind of investments.”* (BBSRC)
- BBSRC continues to see the continuing influence of the synthetic biology dialogue in helping foster trust in research on synthetic biology and in BBSRC’s role within that: *“by doing the dialogue early and by doing it well and by doing it in a way that involved a lot of very diverse stakeholders so that the report and the outcomes of the dialogue were credible to a diverse stakeholder group, and by responding to the dialogue and changing what we do in certain ways, that does undoubtedly foster trust in synthetic biology and the ways that research councils operate. There is broad support for it across a range of stakeholder groups. So I guess, if we hadn’t done the dialogue - would synthetic biology be in such good health as it is now?”* (BBSRC)

*“The hope is that synthetic biology, as one of the [Government’s] eight great technologies can drive inward investment, improve industrial processes etc. By trying to make sure that synthetic biology is funded, certainly by the research councils, in a way that can command stakeholder and public trust helps support synthetic biology as a sector and perhaps helps improve inward investment.”*(BBSRC)

The dialogue continues to have benefits for BBSRC as an organisation: *“The substantive reasons [for using dialogue are about us] trying to improve our decision making so that we can invest the public funds we have as best we can and make better decisions. There are also some normative reasons - we’re publicly funded and we feel a duty on us to make sure we invest those funds in a way the tax payer has broadly had an opportunity to influence and shape. There are also probably some fairly instrumental reasons around – such as making sure that research councils and our investments in synthetic biology can be seen to be trustworthy. By doing dialogue we can help foster confidence in the research system and bring stakeholders with us on the direction of travel. It’s a mix but by far the most important reason to do dialogue is to help us make better decisions.”* (BBSRC)

*“Not just the synthetic biology dialogue but various dialogues, but this dialogue was a particularly successful project which has been useful to the organisation. They have all helped us make better decisions. So I think within the BBSRC and research councils more broadly I would say that public dialogue is credible and it has been robust enough to use in decision making.”* (BBSRC)

*“The value of being in an organisation that sees public dialogue as important way of supporting decision making means that not only do we make better decisions, but it allows us to demonstrate that we are an organisation which can be trusted. It’s not about looking like we are trusted it’s about being trustworthy so that people trust us. Thoughtful engagement not just with the public but with stakeholders, responding to that engagement, acting differently is all part of our strategy to make sure that research and research funding is something that retains stakeholder and public support.”* (BBSRC)

## References and citations

In addition to the publications cited within this summary, the follow-up evaluation report (2011) included extensive details of citations. The evaluators also produced citations maps that are available and a summary of twitter data following publication of the dialogue report.