

Synthetic biology dialogue Follow up evaluation report

Prepared by Laura Grant and Clare Gardiner, with help from Bella Williams and Ali Fisher

14 April 2011



LauraGrantAssociates

Public engagement
with science and
engineering

Contact: laura@lauragrantassociates.co.uk

Contents

Executive summary.....	3
Introduction	3
Evaluation methodology	4
Key findings	4
Recommendations	7
1 Introduction	9
1.1 Background.....	9
1.2 Dialogue objectives	10
1.3 Key messages from the dialogue	11
2 Evaluation methodology	12
2.1 Evaluation questions	12
2.2 Approach	13
2.3 Methodological note.....	15
3 Findings: Reflections on participation.....	16
3.1 Reflection on interim report findings.....	16
3.2 Length of dialogue.....	16
3.3 An overall success?.....	17
4 Findings: Personal outcomes	18
4.1 Learning, attitudes and behaviour	18
4.2 Public engagement.....	21
5 Findings: Implementation environment	22
5.1 Scientific advances	22
5.2 Twitter-sphere.....	24
6 Findings: Impact and activities since the report.....	25
6.1 Report citations and links.....	25
6.2 Views about the report	28
6.3 Awareness and perception of post-report activities	29
6.4 Embedding workshop.....	31
7 Findings: Policy and other impacts	37
7.1 Policy influence	37
7.2 Work still to do	40
8 Findings: Cost-benefit.....	41
8.1 Actual costs	41
8.2 Perceptions of value.....	42
9 Conclusions and recommendations	44
10 Recommendations	48
Appendix 1: Summary of interim evaluation findings	50
Appendix 2: Follow-up telephone interview stimulus	53
Appendix 3: Citations data.....	55
Appendix 4: Twitter data	63

Executive summary

Introduction

In 2009 the Biotechnology and Biological Sciences Research Council (BBSRC) and the Engineering and Physical Sciences Research Council (EPSRC), with the support of the Department for Business, Innovation and Skills' Sciencewise-ERC programme¹, commissioned a public dialogue on synthetic biology. TNS-BMRB was commissioned to deliver the dialogue, and Laura Grant Associates was appointed as the external evaluator. The dialogue had the following aim:

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.

The dialogue consisted of:

- Twelve **deliberative workshops** that brought 160 members of the public together three times in four locations (London, Llandudno, Newcastle and Edinburgh) along with scientists, social scientists and representatives from the Research Councils;
- A **reconvened workshop** involving eight public participants (two from each location);
- Forty-one **stakeholder interviews**.

Stakeholders including scientists, engineers, social scientists, Government, Research Councils, Sciencewise-ERC and NGOs were engaged through the dialogue Steering and Oversight Groups.

The report was published on the BBSRC website² and hard copies were distributed to over 200 stakeholders. A number of follow-on activities also took place:

- A **report launch** event in London in June 2010;
- Dialogue findings were taken to the relevant **committees** in BBSRC (Bioscience in Society Panel) and EPSRC (Societal Issues Panel) in Summer 2010;
- The **CEOs of BBSRC and EPSRC met** in October 2010 to discuss the dialogue. A **joint letter** stating their planned responses to the recommendations was also sent to participants and stakeholders that month.
- The CEOs of the EPSRC and BBSRC sent a **letter to the Chief Scientific Advisor** outlining the public concerns around regulation raised during the dialogue;

¹ The Sciencewise Expert Resource Centre -(ERC) funded by the Department for Business, Innovation and Skills (BIS), helps policy makers to understand and use public dialogue to inspire, inform and improve policy decisions around science and technology. It consists of a comprehensive online resource of information, advice and guidance together with a wide range of support services aimed at policy makers and all the different stakeholders involved in science and technology policy making, including the public. The Sciencewise- ERC also provides co-funding to Government departments and agencies to develop and commission public dialogue activities.

² See <http://www.bbsrc.ac.uk/news/topic/corporate-synthetic-biology/>

- A **Parliamentary Scientific Committee meeting** that focused on the dialogue was held in December 2010 in Westminster;
- An **embedding workshop** for the synthetic biology community was held in Bristol in February 2011. 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.

Evaluation methodology

The interim evaluation was completed in July 2010³. It included observation at workshops, questionnaires for public participants and interviews with expert participants and stakeholders. A summary of key findings from the interim evaluation is provided in Appendix 1. The purpose of the follow-up evaluation was to explore the impact and outcomes of the dialogue six to eight months after the report was launched. Evaluation methodology during the follow-up comprised the following three strands:

- **Follow-up telephone interviews** were conducted with six members of the public, four expert participants and six other stakeholders;
- **Mapping activities** identifying citations and links to the dialogue report and also synthetic biology activity on Twitter over the duration of the project;
- **Observations** at the embedding workshop in February 2011 and a brief **e-survey** with 24 participants.

Key findings

Policy influence

I think that really can get rated in reality in twenty-five years' time. I think it's got the potential to do that. I can't think of a single policy that has changed because of it but I certainly think it's got potential or it'll enable that to happen...it's started the conversation and long may that conversation continue...

(Stakeholder)

Stakeholders and others were reticent to state that policy had been influenced, but four clear outcomes emerged following the dialogue:

1. Providing impetus for Research Councils to take the public concerns about synthetic biology to **regulators** via discussions with the Chief Scientific Advisor;
2. Catalysing and informing EPSRC's work on **responsible innovation** by linking to the dialogue through the Societal Issues Panel;
3. BBSRC are reviewing their approach to **ethics in grants** as a direct result of the dialogue, which in turn has created opportunities for the public engagement team to collaborate with colleagues that work on research funding;

³ See <http://www.bbsrc.ac.uk/documents/synbio-dialogue-interim-evaluation-pdf/>

4. Prompting an **RCUK proposal to Sciencewise-ERC** to fund research that draws together the findings across dialogues in areas of emerging technologies.

Whether or not all of these four areas count as ‘policy influence’ is arguable, and some of these outcomes cannot be attributed to the dialogue alone (for example the work on responsible innovation was already underway). However they are an encouraging indication of the extent to which the messages from the dialogue have been taken on board. At this stage of the process, ways in which the dialogue had or might influence other Research Councils and/or central government were unclear.

A number of mechanisms promoted policy influence, some outside the control of the RCs and others. In summary, the mechanisms were:

- Structures in place at the **Research Councils** e.g. senior buy-in, active and influential committees (e.g. SIP, BSS), RC staff commitment, the nature of the RCs as policy making organisations themselves with close links to central Government.
- The resonance of the dialogue messages with **discussions that were already going on** in Research Councils that allowed other areas of work to be joined up e.g. responsible innovation.
- **External factors** that raised the profile of the dialogue: the report was launched shortly after Craig Venter’s announcement and it was also the first dialogue to be published following the appointment of the new Science Minister, who took an interest in the work. The timely nature of the dialogue also meant it was able to inform a review into synthetic biology going on in the US⁴.

For future dialogues, identifying which of these types of drivers can be employed to maximise policy and other influences might be beneficial.

Some of our interviewees had a perception that the different cultures within the two lead Research Councils supported or limited the extent to which the dialogue findings could be taken forward (e.g. culture of innovation, where the public engagement team is situated). This view was not shared by all interviewees: others felt the approaches were complementary and offered an opportunity for mutual learning. It is natural that different organisations will have different cultures, and these contexts should not be neglected when exploring the nature and extent of influences on policy and practice.

⁴ See [Reference/webpage no longer available – Feb 2016]

Outcomes for participants

I'd probably say that three or four times since when I've been browsing web pages I've done a search on synthetic biology to see what's going on.

(Public participant)

Public participants found the process interesting and reported learning about synthetic biology, although when prompted few felt confident describing exactly what it was. They had entered the process with few expectations and were satisfied with the audiences the report had reached. In the interviews, shifts in attitude appeared less pronounced compared to the initial questionnaire feedback, which suggests that these outcomes diminish over time. However several interviewees described taking a renewed interest in synthetic biology and science more widely that had been sustained until the time of the interviews (although this may also have been a factor in sample members agreeing to participate in this stage of the evaluation). This renewed interest took the form of web searches on synthetic biology or other topics, taking an interest in relevant news items that may not have registered before, feeling able to 'see through the nonsense' that can be published about science in some media, and continuing to discuss the topic with friends and family.

For experts there was considerable learning about public views, as would be expected for a dialogue of this type. Interestingly, one scientist felt that attending the workshops and interacting with members of the public was more valuable in this regard than reading the report.

Ongoing dialogue

...if you spend over £400,000 on something you can't just put the report on the shelf; you actually need to do something with it. And the sort of physical manifestation of the [CEO] letter as it were, is almost us saying look we're going to do something with it, here's a list of things we're going to do, do hold us to account please and make sure we do them.

(Stakeholder)

A strong message from this evaluation is the importance of continuing the dialogue. In the cost-benefit analysis, judgements on the value of the dialogue, especially in terms of its potential to impact on future policy, depended on whether the findings were listened to. Many interviewees (public, expert and stakeholder) also tended to caveat their opinions of 'success' in this way, suggesting that an enjoyable and 'successful' dialogue process was all very well but it was only really valuable if its findings were listened to and acted upon where necessary.

Exactly what the ongoing public engagement could look like was explored in the embedding workshop. A number of issues were raised:

- Everyday work is incremental but the field as a whole can be transformative. How will tipping points with strong social implications be identified?

- Social implications are considered by scientists, but how can this be articulated? How will the public know they have been listened to?
- Researchers' motivations are multiple, diverse, and not always conscious;
- Applications are far away, which can make identifying implications difficult. When is the right time for engagement, and what types of engagement are appropriate at different times?
- Some researchers felt they lacked the confidence, skills, time and/ or institutional support and recognition to engage;
- Who is responsible for supporting engagement? Researchers? Research Councils? Public engagement professionals?
- Social and online media provide potential new platforms for engagement, especially with those that are already interested and informed;
- Among a minority, there appears to be mutual mistrust between scientists and social scientists/public engagement practitioners;
- The low public awareness of synthetic biology means scientists may focus solely on science communication activities at the expense of engagement. Ideally a balance would be struck between the two.

From our interviews, it appeared that the Research Councils were looking to the research community to continue the dialogue, and the research community were looking to the Research Councils to direct and support the engagement. The exact nature of these roles is important if the dialogue is to continue and the potential value of the investment to date realised.

A further challenge identified in the interviews was how to keep the public involved in this dialogue. Public participants we interviewed had mixed expectations about this, but there are some basic processes that can be improved e.g. effectively communicating why contact details are required and managing expectations about further involvement (e.g. some participants were expecting to hear about online engagement).

Recommendations

Learning points for future dialogues

Key learning and good practice points for dialogue follow-up are:

- Consider data protection issues early to enable as many participants as possible to provide contact details and stay informed about the dialogue.
- Manage participants' expectations about continued dialogue.
- Think about dissemination and embedding at the commissioning stage. Identify channels and allocate funds as appropriate, but do not plan too closely as it is important to have flexibility to respond to the dialogue findings. The embedding workshop was a good example of how this can be done.

- Encourage as many experts or stakeholders as possible to attend workshops. For one participant this was much more valuable in understanding public views than the report. In addition, consider presenting outcomes in different media as well as a written report.
- When engaging experts, ensure they are briefed on the structure of the dialogue as a whole, rather than the public engagement aspect alone. This will help them make sense of the findings.
- Continue to work with the scientific community to foster understanding of what a dialogue process is and how the findings can be interpreted. Creating space to discuss these is helpful.
- Consider and communicate what is meant by 'policy impact', especially in the case of upstream dialogue. What does success look like for engagement in an emerging field such as synthetic biology? The dialogue report called for culture change within the RCs and scientific community. How can this be evidenced?
- Identify which mechanisms might maximise policy influence and make the most of them. These include existing structures and timely opportunities such as related media stories.
- The issues of support, recognition and reward for public engagement among academics will limit the extent to which they are able to prioritise continued public engagement. Research Councils and others should be mindful of these issues in their expectations of researchers, and work to offer support and reduce barriers where possible.

Key questions for ongoing dialogue

The follow-up evaluation has identified three questions related to ongoing dialogue about synthetic biology:

1. How will the public know they have been listened to?
2. What are the roles and responsibilities for researchers, Research Councils and others (e.g. public engagement practitioners) for continuing the dialogue? How will this be funded and supported?
3. How will learning be taken to other Research Councils and research communities, including internationally?

1 Introduction

1.1 Background

In 2009 the Biotechnology and Biological Sciences Research Council (BBSRC) and the Engineering and Physical Sciences Research Council (EPSRC), with the support of the Skills' Sciencewise-ERC programme, commissioned a public dialogue on synthetic biology. The dialogue had the following aim:

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.

TNS-BMRB were commissioned to deliver the dialogue, and Laura Grant Associates was appointed as the external evaluator.

The dialogue consisted of:

- Twelve **deliberative workshops** that brought 160 members of the public together three times in four locations (London, Llandudno, Newcastle and Edinburgh) along with scientists, social scientists and representatives from the Research Councils;
- A **reconvened workshop** involving eight public participants (two from each location);
- Forty-one **stakeholder interviews**.

Stakeholders including scientists, engineers, social scientists, Government, Research Councils, Sciencewise-ERC and NGOs were engaged through the dialogue's Steering and Oversight Groups. A number of follow-on activities also took place:

- A **report launch** event in London in June 2010;
- Dialogue findings were taken to the relevant **committees** in BBSRC (Bioscience in Society Panel) and EPSRC (Societal Issues Panel) in Summer 2010;
- The **CEOs of BBSRC and EPSRC met** in October 2010 to discuss the dialogue. A **joint letter** stating their planned responses to the recommendations was also sent to participants and stakeholders that month.
- The CEOs of the EPSRC and BBSRC sent a **letter to the Chief Scientific Advisor** outlining the public concerns around regulation raised during the dialogue;
- A **Parliamentary Scientific Committee meeting** that focused on the dialogue was held in December 2010 in Westminster;
- An **embedding workshop** for the synthetic biology community was held in Bristol in February 2011. 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.

1.2 Dialogue objectives

Aim

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.

Objectives

- Facilitate discussions from diverse perspectives, which are undertaken by people who are inclusive of a range of people in society;
- Support a diversity of key stakeholders and people with relevant knowledge (e.g. industrial, regulatory, NGOs, civil society) to oversee the dialogue to ensure its fairness, competence and impact.
- Draw on and seek participation of a diversity of knowledge by working with a wide range of groups, including researchers, Research Council staff, social scientists and NGOs with an interest in issues related to technology options and/or synthetic biology.
- Ensure that the content and format of the dialogues are open to influence by all of the participants.
- Allow institutional learning about dialogue processes, including the diversity of views, aspirations and attitudes that exist with reference to scientific, economic and social policy and economic aspects of new technologies.
- Develop a capacity amongst all of the participants for further dialogues in the future and seek views about priority areas/issues which would merit further substantive dialogue, debate and information.
- Improve on what is seen as good practice and thus provide a foundation on which broader future engagement can build and inform the development of a longer term project of engagement.
- Raise awareness and capacity within the Research Councils, policy makers and the scientific community of aspirations, concerns and views in relation to synthetic biology and the importance of dialogue.
- Ensure that participants in the dialogue have a meaningful route to potentially influence policy makers and thus feel their involvement has been worthwhile.
- Devise novel ways of dealing with an area of technological development in which very few specific details are known.

1.3 Key messages from the dialogue

These key messages are taken from the Synthetic Biology Dialogue Overview⁵. Please note this is an excerpt from an overview of a detailed and nuanced dialogue report. It is provided here as context for readers of this report, rather than as a summary of the dialogue conclusions. We recommend readers refer to the full dialogue report to gain the best understanding of public and stakeholder views.

Excerpt on public and stakeholder views

When considering science and technology, people expressed support for progress but they also believe developments in biotechnologies and genetic sciences push moral boundaries and might widen the rich/poor divide.

Overall, synthetic biology is regarded as both exciting and scary by the public. A specific concern among participants is it could impact on our relationship with nature. They feel artificial entities have less intrinsic value than natural ones. Scientists and engineers often feel this idea of creating nature is an unhelpful way of viewing their work. Stakeholders are aware that there are potential risks with synthetic biology and that regulation is needed. But many risks are currently unknown so any comprehensive 'assessment' is difficult.

Stakeholders do support robust regulation which also allows for legitimate innovation and progress. For the public, the need for effective regulation and control is one of the most important issues - they do not believe scientists should self-regulate.

The report highlights people's desire to be more involved in the development of synthetic biology. However, some scientists are anxious about the level of this involvement.

Questions for scientists involved in synthetic biology

A key conclusion from the report is that synthetic biology scientists must be encouraged to think through the responsibilities of their work more robustly. The five central questions for synthetic biology that emerged from the workshops were:

- 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?

⁵ See <http://www.bbsrc.ac.uk/documents/synbio-summary-report-pdf/>

2 Evaluation methodology

2.1 Evaluation questions

The following evaluation questions were identified based on the project aims:

1. **To what extent did the project meet its aim and objectives?**
2. How effective were the approaches, methods and tools used within the dialogue? What factors contributed to their effectiveness (or lack thereof)?
3. How effective were the steps taken to engage the diverse knowledge of participants and stakeholders, and participants and with diverse backgrounds? To what extent was the dialogue inclusive?
4. Linked to question 3, what role did the Oversight Group, Sciencewise-ERC and others play in the dialogue development process? How did those involved in development feel about the management of the process?
5. **To what extent are the dialogue's outcomes specific to synthetic biology or related to general trends across emerging technologies?**
6. What mechanisms were used to identify and incorporate good practice? How effective were they?
7. **What mechanisms were used to maximise policy impact (e.g. direct contact between public participants and policy makers) and how effective were they?**
8. **Did the process and results of the dialogue have an impact on policy? In what way and to what extent?**
9. **What did scientists/engineers/Research Councils/policy makers and other stakeholders learn about...**
 - a. **Public attitudes, aspirations and concerns regarding synthetic biology?**
 - b. **Dialogue tools and processes?**
 - c. **The advantages and limitations of public engagement with these types of issues?**
 - d. **Any other aspects?**
10. **What were the outcomes for the various participants (including members of the public, scientists, engineers, policy makers and Research Councils) and how did these compare to the outcomes anticipated at the start of the project?**
11. **What learning and good practice should be taken forward for future dialogues?**

The evaluation questions highlighted in bold text (1, 5, 7, 8, 9, 10 and 11) are fully or partially addressed by this report, whilst those questions in normal text were addressed in the interim evaluation report.

2.2 Approach

The interim evaluation was completed in July 2010 and included the following elements:

- **Structured observation and snapshot interviews** during the public workshops;
- **124 exit questionnaire surveys** from the 130 public participants who attended all three workshops;
- **Interviews** to capture and understand the expectations of and outcomes for experts, stakeholders and policy makers including 10 interviews with members of the steering and oversight groups.

A summary of key findings from the interim evaluation can be seen in Appendix 1. The interim evaluation report can be downloaded here:

<http://www.bbsrc.ac.uk/documents/synbio-dialogue-interim-evaluation-pdf/>

The purpose of the follow-up evaluation was to explore the impact and outcomes of the dialogue six months after the report was launched. Evaluation methodology during the follow-up comprised the following three strands:

Telephone interviews

Sixteen follow-up telephone interviews lasting between 20 and 60 minutes were conducted between 17th January and 1st February 2011 with:

- Six public participants;
- Four expert participants;
- Six other stakeholders.

Interviewees were recruited via an invitation email (sent to those who had given their permission to be contacted for the follow-up evaluation) and were selected to meet criteria which ensured that as broad a range of opinions as possible would be gathered. In addition, telephone recruitment ensured that public participants that did not have access to email were represented in the sample. We also spoke informally with the dialogue contractor to gain a sense of the extent to which outcomes had been anticipated.

The six public interviewees included at least one from each of the four workshop locations (London, Edinburgh, Llandudno, Newcastle), one who had attended the reconvened workshop (in London, May 2010, to validate report findings pre-publication) and one who had attended the report launch event (in London, June 2010).

The four expert participant interviewees included two scientists and two social scientists. Three of the four workshop locations were represented.

The six stakeholder interviewees were selected to represent a variety of viewpoints and levels of involvement in the dialogue. These included Steering and Oversight Group

members and staff involved in commissioning the dialogue (from BIS and the two Research Councils).

Interviews all covered these broad headings (to varying extents with each interviewee):

- Why and how they got involved;
- Reflections on involvement;
- Timing and wider context for the dialogue;
- Awareness of what has happened since;
- Impact and outcomes – overall and personally;
- Cost-benefit analysis.

Interviewees were sent a project timeline in advance of the interview and this was used as stimulus material throughout the interview to aid discussion, particularly around the extent of each individual's involvement and their awareness of activities since the dialogue report was launched. This stimulus material can be found in Appendix 2.

Mapping activities

Two sets of information have been mapped visually to illustrate the context and environment in which the synthetic biology dialogue has taken place and in which its findings may be interpreted:

- Twitter-sphere;
- Citations of and links to the dialogue report.

Twitter⁶ is a social media that allows individuals (and organisations) to concisely comment on topics in which they are interested –each 'tweet' is restricted to 140 characters. It is common for tweets to include shortened hyperlinks to longer information sources, for example, news articles or reports. Users can follow the tweets of other users which they find interesting. Discussion threads emerge through the use of 'hashtags' (where the symbol # precedes a phrase) to allow users to easily find others commenting on the same topic. In these ways networks of users and discussion topics emerge.

The maps and graphs that depict activity on twitter throughout the duration of the dialogue project are not linked directly to the dialogue, or the report produced from it, *per se*. Instead they depict general activity around the hashtags #synbio and #syntheticbiology over the period May 2010 to February 2011. The frequency of use of these hashtags is noted as is the network of users who use them. Twitter data is presented in Section 5.2 and Appendix 4.

The second set of maps identify citations of and links to the dialogue report that was published in June 2010. This data was gathered through internet searches, by asking

⁶ See www.twitter.com

expert and stakeholder interviewees where they had used the report, and by contacting those who had attended the report launch event. This data is presented in Section 6.1 and Appendix 3.

Embedding workshop observations

The embedding workshop took place on 10th February 2011 in Bristol. The event was organised jointly by BBSRC, EPSRC and Sciencewise-ERC and was attended by an invited audience of members of the Synthetic Biology Networks⁷ and the EPSRC funded Centre for Synthetic Biology and Innovation⁸.

Outputs from the discussion groups were captured on flipcharts and key points from these have been synthesised. Notes and observations from sessions were captured by the evaluators and are commented on in Appendix 5.

2.3 Methodological note

Given the amount of time (10 months) that had elapsed between the final workshop and us contacting participants for these interviews, we were unsure whether we would be able to recruit the sample for the evaluation we set out to. In fact this was not a problem and many participants were happy to contribute to the evaluation. Expert participants were most difficult to recruit due to their other time commitments.

In mapping the citations of the report, it was clear that a strict cut-off date needed to be applied, because new citations were appearing regularly. There is likely to have been renewed interest in the report since the embedding workshop, for example, which we have not been able to account for in this report.

Although this study is more longitudinal than most dialogue evaluations, it still allowed relatively little time for policy impacts to emerge. ‘Keeping in touch’ with the project in between writing our interim report and this report could have been problematic as there was no time in the evaluation contract for the six months between the interim report and follow-up work and it is likely that the timing of the evaluation means we may have missed some issues around the dialogue report launch. However, the proactive approach from colleagues at the Research Councils, BIS and Sciencewise-ERC meant we were kept well informed of developments. This type of support has been crucial to the effectiveness of this study, and for future studies of this type we would recommend allocating a small amount of project management time for evaluators and others to keep in touch between the main study and the follow-up.

We conclude that a follow-up study of this type conducted 6-8 months after the report launch is fairly straightforward to conduct and we hope it will provide some useful

⁷ More detail on the networks can be found here [Reference/webpage no longer available – Feb 2016]

⁸ See <http://www3.imperial.ac.uk/syntheticbiology>

insights into longer-term impacts from the dialogue, as well as some frameworks for future evaluations of these impacts.

3 Findings: Reflections on participation

3.1 Reflection on interim report findings

Many of the findings regarding the effectiveness of the dialogue process itself that were presented in the interim evaluation report were echoed by interviews during this follow up. A summary of the interim evaluation findings can be seen in Appendix 1.

In these follow up interviews, public participants felt that they themselves, and others in their groups had been given sufficient opportunity and encouragement to contribute to discussions. Experts and stakeholders reflected positively on the quality of the facilitation, but a few noted that the style of facilitation varied considerably between groups.

Participants genuinely felt that their opinions had been listened to and valued. Some were more sceptical than others about whether or not the 'purpose' of the activity had been motivated by wanting to 'sell' the idea of synthetic biology, with one member of the public even speculating that this was really another way of packaging the GM issue. Interestingly one public participant who felt the purpose had been to try to (positively) influence public opinion still respected the process because there was open discussion of both the potential developments and risks, and that everyone was allowed to form and express their personal opinions.

...had it all been one sided then it may have had a detrimental effect on my opinion...but by actually providing a little bit of anti and cautious discussion it was - it kind of made it a bit more interesting. (Public participant)

3.2 Length of dialogue

Some interviewees reflected that at times there was a great deal of information for public participants to take in and that this was quite demanding,

...the day was very tiring for members of the public and I didn't think about that in advance. (Stakeholder)

...the length of time as well it can be a long time for people that are not used to being in a kind of learning scenario to give attention for that length of time...but, having said that, conversely, it was fairly tiring but it was varied enough I think particularly as we got into the subject...to be genuinely interesting, [and] with the motivation of getting a few pounds [£] at the end of it all. (Public participant)

In addition, some experts and stakeholders were disappointed that there had been insufficient flexibility in the workshop timings to really allow the public to shape the content of the discussions. Many of the public participants greatly valued interacting

with the experts at the second and third workshops and a few interviewees questioned whether it was necessary to include the general discussions at workshop 1, or if it would have been more valuable to have moved on to discussing applications sooner. This may have had implications on the cost, overall length and the depth of the discussions the dialogue facilitated. However the dialogue report drew distinct ideas from all three workshops, so a considerable section of the report would have been sacrificed had the process been shorter.

...what I remember is when they had the scientists...and they started to explain things and that's when it all started making sense to me. That was the last workshop I think.
(Public participant)

3.3 An overall success?

There was a consensus amongst interviewees (public, expert and stakeholder) that overall, the dialogue had been a success. Individuals' reflections on specific aspects varied in how positive or critical they were, but, when asked to sum up whether the whole exercise had been successful none decided that it had not.

The dialogue was perceived to have been generally well facilitated; to have included a 'cross-section' of participants; and individuals felt they had learned something from being involved in the process. These factors were all cited by interviewees as reasons why they considered it to have been a success and they support the findings of the interim evaluation.

Some stakeholder interviewees were asked to quantify the extent to which they felt the dialogue had achieved its aim by rating this on a scale of 1 (very satisfied) – 5 (not at all satisfied).

- *Aim: "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."*

As the aim is twofold, measuring firstly the diversity of public opinion gathered, and secondly the potential impact of future policy development, these were considered separately. Ratings for the 'diversity' part of the aim ranged from 2 to 4 with the point being made that within the budget, specification and scope of the dialogue project, a good level of diversity had been achieved although this could potentially have been extended.

Stakeholders unanimously found it impossible to rate the extent to which the dialogue achieved the second part of its aim which refers to its potential to influence future policy.

I think that really can get rated in reality in twenty-five years' time. I think it's got the potential to do that. I can't think of a single policy that has changed because of it but I certainly think it's got potential or it'll enable that to happen...it's

started the conversation and long may that conversation continue...
(Stakeholder)

This quote expresses the general aspiration that the process will act as the catalyst for future developments, although it may be difficult to attribute these directly to the dialogue. One stakeholder also pointed out that the dialogue was not conducted with the intention of affecting one specific piece of legislation (i.e. a policy that was due for renewal shortly after the dialogue completed) and therefore laying the foundations of future policy discussions may well be a very worthwhile outcome. These ideas were returned to later in the interviews and are explored in greater depth in Section 7.1.

There was a general sense that the usefulness of the dialogue, especially in terms of its potential to impact on future policy, depended on whether the 'right people' took notice of its findings. It is interesting to note that many interviewees (public, expert and stakeholder) tended to caveat their opinions of success in this way, suggesting that an enjoyable and 'successful' dialogue process was all very well but was only really valuable if its findings were listened to and acted upon where necessary.

4 Findings: Personal outcomes

4.1 Learning, attitudes and behaviour

Both public and expert participants enjoyed the experience of taking part in the dialogue and felt that they learnt from the process, which added to their enjoyment. Having the opportunity to converse with other people who they may not have come into contact with otherwise and explore each other's opinions was welcomed equally by expert and public participants and was a genuinely interesting and stimulating part of the process for many.

About synthetic biology

Public participants enjoyed learning about a new area of science, something which had largely been outside of their awareness prior to taking part in the dialogue. Comments included:

...it opened your eyes to synthetic biology...I learnt a lot, it got me thinking about it.

I think I learnt more or less what synthetic biology is and how much research goes into it, how much money's involved in it, whereas I didn't know those things before.

(Public participants)

When probed further however, some made linkages between synthetic biology and unrelated areas of science, while others appeared to be clearer about the real nature of synthetic biology. So although the public participants reported learning about synthetic

biology, it was apparent that misconceptions had taken hold for some and few were completely confident when encouraged to explain it.

The questionnaires analysed as part of the interim evaluation suggested that the workshops had influenced participants' views about synthetic biology. This was explored further in the interviews, and while public participants felt that synthetic biology was revealed to them during the dialogue, few felt that their views had changed profoundly. Instead they described more subtle shifts in opinion on specific aspects of the issue, or that the workshops had identified views that participants may not have consciously held previously. During the interviews several described concerns relating to GMOs and/or regulation.

In fact I believe it hardened my opinions with regard to synthetic biology.

Wanting to accept the thing as an evolution if anything, but very wary of the regulatory areas and how it is already regulated.

Well maybe I'll have a different view on a couple of things but the basis of my thoughts never changed.

I'm still frightened of GMO, I really am. That really concerns me because it's letting rip a force which could be taken over by nature and nature does its own redevelopment anyway because the way animals develop and respond to external influences.

I think it did switch a little bit from fear of the apocalypse a little bit more to hey this could be pretty good.

(Public participants)

These findings suggest that over time, participants hold on to the information that they have learned, but that shifts in opinion are less marked. This may be because people have had a longer time to incorporate the new information to their existing sets of opinions and world views, which make them appear less striking.

One member of the public explained how he felt it enabled him to view information in the media in a more balanced and informed way:

I've always been interested in science...but this is another branch of science so it just helped me to understand it a little bit more and also just to see through all the nonsense that's sometimes published in the newspapers... Frankenstein genes or something, so I can actually just see through it a little bit better.

(Public participant)

Another interesting outcome from one participant related to their view of scientists:

Just being able to understand it, like they said when you think of synthetic biology you think of crazy scientists and things but they were actually normal people that came to talk to us.

(Public participant)

It was common for public participants to report speaking to their family and friends soon after the workshops. They also tended to report that participating in the dialogue had sparked a personal interest. For some, the increased interest was not limited to synthetic biology, but had a broader impact on their interest in scientific issues:

...anything scientific after going to that. I take more interest in it, like any breakthroughs and things like that.
(Public participant)

The extent to which individuals maintained their interest varied but some reported proactively searching on the internet for information since taking part:

I'd probably say that three or four times since when I've been browsing web pages I've done a search on synthetic biology to see what's going on.
(Public participant)

Some commented that taking part in the follow-up evaluation had prompted them again to search for information.

Most of the expert participants and stakeholders felt that they had not really learnt any new science through participating, largely because these individuals were proactive in keeping up to date with new developments. Most however, did enjoy learning about the specific aspects of the work of others and comparing this with their own work.

Also I learnt about the work of my fellow science expert at the [location] dialogue because he was there for both events
(Expert participant)

For some, the dialogue was also an opportunity to further explore the diversity within the synthetic biology community.

In terms of my thinking about synthetic biology it's always kind of interesting to talk to people who are for some reason put in the synthetic biology box whether by themselves or other people
(Expert participant)

Scientists don't even call themselves synthetic biologists and that itself hasn't really defined itself
(Stakeholder)

Public, expert and stakeholder interviewees all valued the opportunity to explore others' views about synthetic biology. For members of the public, talking to other people (both public and expert) was an important mechanism to stimulate their own learning and interest in the process and the topic.

It was valuable meeting [other public participants], seeing what they think. I mean I'm not to say I'm right with everything I thought so it was nice to hear other people's views. Even if he was going against me I could see his point, if I was thinking one thing, he'd think another thing.
(Public participant)

Expert participants were interested in the public perceptions of them and their work revealed during workshop discussions. Scientists and social scientists were both surprised at the extent to which synthetic biology was viewed in a positive light. One of the social scientists was also surprised at the level of nuance in the public views.

It was interesting to see how well thought through these positive views were, very thoroughly constructed ideas. Because in the – I mean the theory on attitudes is that positive attitudes are often quite simple and it's critical attitudes that are the ones that have been thought out, because if people like something they don't bother to think about it so much. But these people did like it generally and they had thought long and hard about why, but maybe that's because we're in workshop three by now.
(Expert participant)

Interestingly, stakeholders were more likely to refer to the dialogue report rather than the workshops when describing their learning about public views. For some, the findings were aligned with their own personal and professional views, while for others elements of the report were surprising.

Some of the things that are most interesting to me are the things that didn't come out of it, some of the concerns – some of the issues that we flagged up as potentially very significant issues didn't really come out. And perhaps that explains to some extent why there hasn't been the huge media panic about synthetic biology than there was about genetic engineering in terms of GM. of course I now have a much deeper understanding of how other people perceive it, which I must actually say is largely how I perceive it as well. So I mean that's quite interesting, it's always interesting to see either what you believe to be affirmed or otherwise, by other people. But generally I've agreed with many of the outcomes

(Stakeholders)

4.2 Public engagement

Taking part in dialogue was largely a new experience for members of the public and they reflected that they were generally interested to experience what it was like.

Expert participants, especially those who had little or no experience in public engagement activities, valued the professional challenge and learning that was involved.

...it was challenging me to think about presenting my work and presenting the science in a completely different way. Obviously we're trained to present to colleagues and (committee) members but to then have to stop think about, oh now, this is a completely different set of people, how do I package it for them? That was a very eye opening process for me.
(Expert participant)

Public and expert interviewees said they would be happy to be involved in a similar process again, and some experts have since taken on further public engagement

activities, for example outreach work. However, despite sparking a personal interest and commitment to public engagement in some, questions still remain with regard to whose responsibility it is to do such activities, and to what extent public engagement activities are recognised and rewarded within academia.

As an academic the metrics that our success are measured on are pretty limited. How many grants can you get, how much income can you generate, how many papers you write, that's about it ... you know, if you're doing public dialogue people assume you're doing public dialogue because you can't actually do the science.
(Expert participant)

The stakeholder interviewees reflected on public dialogue in greater detail. Some offered critiques of aspects of the methods used (for example the potential for scientists to introduce bias) or whether the process was truly dialogic.

I did feel that one person in particular who was very good at presenting himself as a nice chap, actually had an undue influence on the opinions of some of the public.

It all depends on your interpretation of a dialogue because to me it was a really, really in depth well run qualitative piece of research. To me a dialogue is when the people themselves choose what they want to talk about
(Stakeholders)

There was considerable learning for the Research Councils and Steering/Oversight group members about this type of dialogue process. For some this had also stimulated reflection on how the dialogue can be continued or embedded. We will discuss this further in Section 7.2.

I've learnt a lot more about public dialogue and about how difficult it is to conduct a dialogue that's effective, it's a real challenge and very messy, it's a messy business, you don't always – things don't always go in the direction you expect them to go or you have to – if you're a contractor working in the area I've learnt that you really have to be pretty fleet on your feet to keep a thing going.

As far as the dialogue and its value and so on and so forth I guess I've learnt that it's – or it's reinforced should I say, that you absolutely need to be very clear in your aims, what you're trying to achieve and of course in the scope of influence.

(Stakeholders)

5 Findings: Implementation environment

5.1 Scientific advances

In the time since the synthetic biology dialogue was commissioned, the world has changed. The most relevant changes that are likely to have affected the ways in which the dialogue findings were used were the general election and subsequent change of

Government and new science minister, and Craig Venter's announcement of a synthetic biology 'breakthrough' in May 2010⁹. Stakeholders acknowledged the effects of the environment on the dialogue outcomes.

There's no point in pretending that if we've had said exactly the same things six months later we'd have got the same results, because things move on and things change.
(Stakeholder)

The change of Government has implications for public engagement in a wide range of areas, so here we will focus on developments and discourse around synthetic biology.

Opinions varied about whether the dialogue findings might have been different if the workshops had taken place after Venter's announcement. As one expert acknowledged,

I think as someone who's interested in synthetic biology it's really easy to overestimate the impact of that [Venter]
(Expert participant)

One expert felt that the announcement meant that the dialogue findings were out of date, but this view was not widely shared.

In terms of now taking the learning from the workshop and taking it out to the public, now the workshop is kind of out of date because everybody does have an opinion, an opening opinion...the environment in which the output of the dialogue process – the output is in a different situation. (Expert participant)

Indeed, most of the public interviewees said they had not noticed it, and just two said they 'vaguely remembered' something about it. Despite the fact that they had participated in the dialogue and some, as a result, reported being more aware of and receptive to relevant press stories. It appears that the Venter story did not greatly penetrate the public consciousness. As one of the interviewees in our interim evaluation remarked:

Some tabloids tried to whip up a debate and failed
(Interim evaluation interviewee)

So while it appears that there would have been little impact on public views had the dialogue been held later, it was impossible to predict the media and public reaction to the story. One of the social scientists summarised the difficulty in timing a dialogue or other engagement process perfectly:

But there's always – there's a kind of thing called the Collingridge dilemma¹⁰, where if you get involved too late everything's already set in motion and you

⁹ Gibson D et al. (2010) *Creation of a bacterial cell controlled by a chemically synthesized genome sequence* (in Science Express Research Articles)

¹⁰ Collingridge D. (1980) *The Social Control of Technology* (New York: St. Martin's Press; London: Pinter)

- *Safety Rules Can't Keep Up With Biotech Industry*
http://www.nytimes.com/2010/05/28/business/28hazard.html?_r=1&src=tptw
- *Designing Life: What's Next for J. Craig Venter?*
<http://www.cbsnews.com/stories/2010/11/18/60minutes/main7067478.shtml>

There are three main themes in the Twitter conversations that make up the map:

1. Comments concurring with NYT article; Safety Rules Can't Keep Up With Biotech Industry;
2. Commentary on Craig Venter; including Designing Life: What's Next for J. Craig Venter?
3. Slice (Movie) 2009 Directed by Vincenzo Natali - discussion of whether it was the first synthetic biology movie.

This suggests that the information currently circulating is concentrated within a relatively small community, both for and against synthetic biology. The dialogue report hardly features in the broader conversations about synthetic biology.

6 Findings: Impact and activities since the report

6.1 Report citations and links

The full report is published here

<http://www.bbsrc.ac.uk/news/topic/corporate-synthetic-biology/> and hard copies were distributed to over 200 stakeholders.

The network map over the page shows where the report was cited. In total 96 citations were identified and are provided in Appendix 4. These can be cross-referenced with the

• number in the report to provide more detail on each. They are colour coded as follows

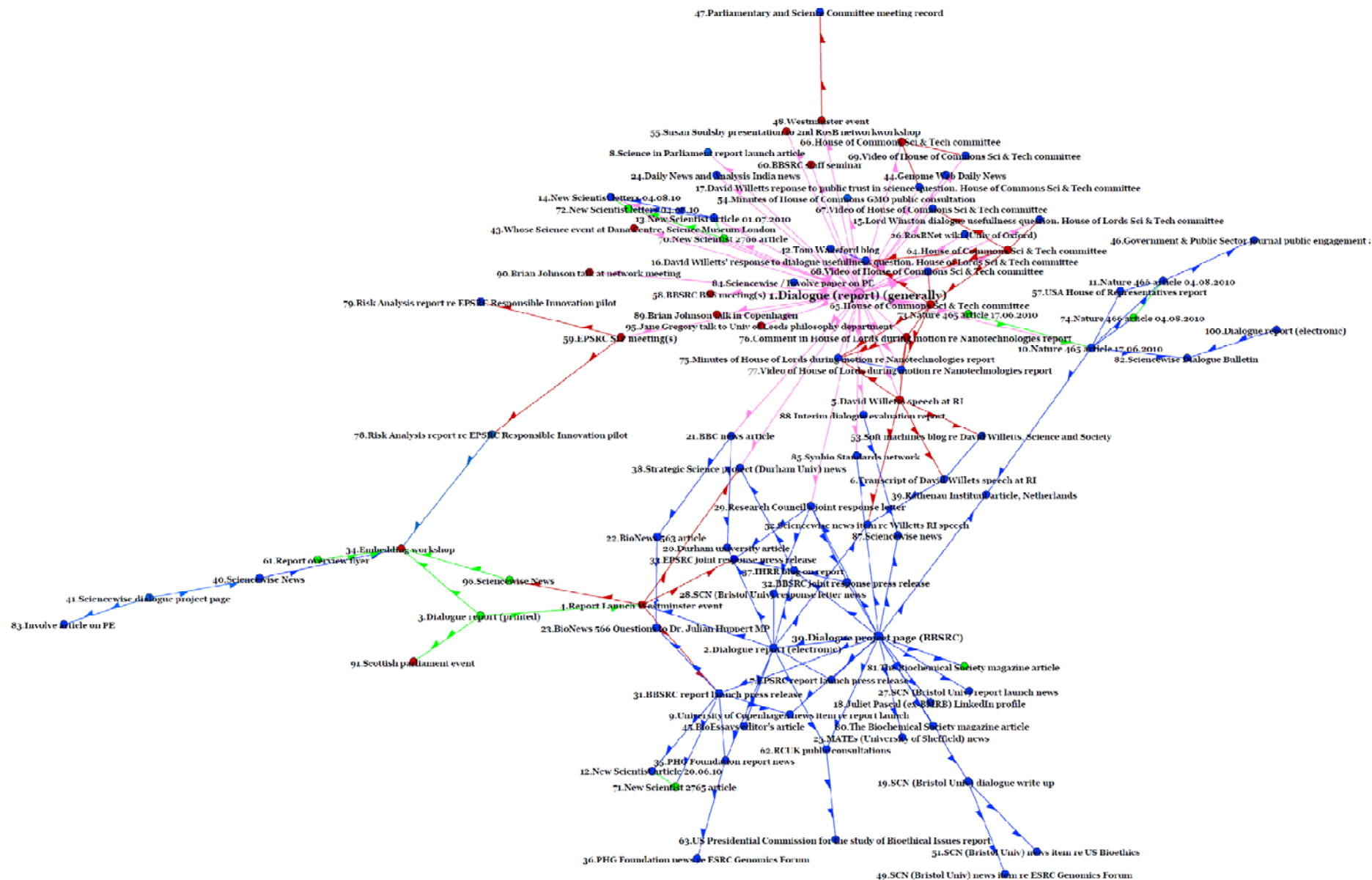
- Blue – web
- Green – print
- Red – event

In some cases, one activity can be represented several times. For example the discussion about dialogue in the House of Commons Science and Technology Committee in July 2010 is cited as an event, but a video of the exchange is also available so that has been cited as well. In this way, information is exchanged between the different channels/media.

The arrows show the direction between 'parent' and 'child' nodes; i.e. the child node will have cited the parent node as a source.

The map shows that most citations are only one step away from the report itself, either citing the dialogue directly or linking to the electronic version or BBSRC project page. However the network map also identifies other activities that generated additional

conversations. The most significant appear to be David Willetts' speech at the RI in July 2010, the report launch in June 2010 and a Nature World View Column: *Talking the talk* in June 2010. It is also interesting to look at the nodes near the edge of the network which may help the report reach new audiences. Bristol University, the embedding workshop and EPSRC Societal Issues Panel appears to be significant in this regard.



6.2 Views about the report

Public participants were happy that the report reflected their views accurately, although several had found it a less than accessible read. Others that attended the workshops also felt that public views were well reflected in the report.

It was pretty big, you know, four sessions throughout the UK, so you're getting a good mix of society, pretty good demographics and yeah it was professionally produced, the feedback was honest and it did reflect what I recalled.

I must admit that I didn't read it thoroughly; I just sort of perused it you know. It was a bit deep for me.

(Public participants)

The exceptions to this were the two scientists who were interviewed. Neither realised that the dialogue included the series of stakeholder interviews, and were therefore surprised that the report did not present public views alone.

Certainly when I got involved in the public side of things, I thought it was just a public dialogue, I didn't realise that part of the process was a dialogue with other stakeholders. So it surprised me very much that so much weight had been given to their opinion as opposed to what I believed the process was about.

(Expert participant)

One of the social scientists was concerned that readers would place too much emphasis on the graphs based on the electronic voting, as she felt they would give an over-simplified summary of public views.

Apparently there's some kind of graph at the very end of the dialogue report, which some people have jumped on and said it was a result. Well it wasn't a result, it was just – the whole point of the voting was really just a kind of fun alternative engagement strategy and it wasn't meant to produce results ... it's not just a tick or a cross, it's kind of well it depends and what about this, what about that? Those are not simple easy take home messages.

(Expert participant)

In contrast, one of the scientists felt that the report should have included more quantitative data, suggesting that those who are accustomed to dealing with facts and figures may find it difficult to assimilate the information from a qualitative dialogue process. He had gained a better insight into public views from participating in the workshops compared with reading the report.

[I] found attending in person and listening and participating much more useful and valuable than looking at the report ... [I] expected the report to be more written for scientists and engineers, to have hard data for example percentages indicating strengths of opinion

(Expert participant)

One of the Research Council representatives commented that the messages in the report were challenging, i.e. the recommendations would not be straightforward to implement, and that this gave him confidence that the report truly reflected public views.

I wouldn't say that all the messages coming from the dialogue were comfortable messages for us to receive... ...there were a lot of really difficult messages in the dialogue for us to take away and think about. (Stakeholder)

Several of the stakeholder interviewees discussed how many of the messages from the report could be applied across a range of emerging technologies. The implications of this are discussed in greater detail in Section 7.1 on policy influence.

Their core recommendations weren't specifically about synthetic biology and I know these questions have been raised before in other emerging technologies but I thought that was an interesting way to put it all together.

What we probably need to get to the roots of are what are the key concerns that people have when these sorts of new technologies come along and how can we assure them that they're being researched, developed and implemented in the most appropriate way. And how can we address any sensitivities they may have about the extent they should be applied or the rate at which they should be applied?

(Stakeholders)

6.3 Awareness and perception of post-report activities

The post-report activities are summarised in Section 1.1. They included meetings of relevant panels within BBSRC and EPSRC, a meeting and joint response to the dialogue from the CEOs of the two Research Councils, a letter to the chief scientific advisor, a Parliamentary and Scientific Committee meeting and an embedding workshop for the synthetic biology community.

The interviews used stimulus material (presented in Appendix 2) as a means of updating participants on the activities that had taken place since the dialogue. Some public participants were aware of these (for example those that had attended the reporting workshop or launch), but others were unaware. It emerged that while some participants had provided their contact details to the evaluators, they had not signed the form that said they would like to hear about what happens next. There was some confusion about this at the workshops (consent for contact had to be requested twice due to Data Protection) and unfortunately it meant that not all participants received a copy of the joint response letter, or invitations to the various other opportunities. So to some, the activities described in the stimulus were new.

Those that did have the opportunity to participate in later stages of the dialogue felt privileged to have been invited.

Yeah, I mean two out of sixty, I thought hey, hey, I've come out on top. And you know, it was an education going down on the train and just stopping one night at a hotel and I mean we were only there about an hour, well an hour and a half, two hours and then we came back. (Public participant)

Others were content that their participation finished at the end of the final workshop (aside from the evaluation interview).

Well I'm kind of ambivalent about that, it doesn't really matter to me – for me it was we participated in something over three days, we gave our inputs, we've received feedback, we're ok with that and really it's over to you if you want to involve us again, we don't expect it. (Public participant)

One public participant has a son who is very interested in politics, and who took an interest in David Willetts' references to the dialogue. The interviewee had not picked this up previously.

Yeah he likes politics and he said you don't even know who David Willetts is and I had to say well who is he then? So yeah it is something that we probably would talk about now I know. (Public participant)

On the whole, public participants felt satisfied that their views had been taken forward in all of the ways described.

I'm glad it got to the ministers and the government and I'm glad that you know, that it has been discussed and hopefully that the public will be more informed. (Public participant)

Expert participants were generally aware of many of the outcomes following the dialogue. Most would have liked to have participated in more of the opportunities, but found themselves constrained by other commitments. Several of the expert participants did attend the embedding workshop which is discussed in Section 6.4.

Stakeholders were generally pleased with the impact of the dialogue to date, and the fact that work was ongoing.

I thought that sort of coverage [in the scientific media] was really pretty heartening and to my mind made the whole thing worthwhile because it meant that the messages from the dialogue were reaching a wider scientific community.

I did notice way back that there was real danger that first step could also be the last, but it doesn't look as though it is.

(Stakeholders)

One stakeholder summarised the role of the joint letter in cementing the commitment to take on the dialogue's recommendations.

If you spend over £400,000 on something you can't just put the report on the shelf; you actually need to do something with it. And the sort of physical manifestation of the [CEO] letter as it were, is almost us saying look we're going to do something with it, here's a list of things we're going to do, do hold us to account please and make sure we do them. (Stakeholder)

6.4 Embedding workshop

A full report on the embedding workshop is provided in Appendix 5. This section combines findings from observations, evaluators' notes, flipcharts and an e-survey conducted in the week following the event.

The workshop

The embedding workshop was held in February 2011 in Bristol. It was attended by around 40 members of the synthetic biology community. These included scientists, engineers, social scientists, public engagement specialists, designers and artists, as well as representatives from the Research Councils and Sciencewise-ERC.

Broadly, the day was split into three parts. Firstly, participants heard presentations about the dialogue and discussed its messages and implications. Secondly, each of the synthetic biology networks plus the centre at Imperial College, London shared their work on public engagement with synthetic biology via elevator pitches and posters. Finally, there was some structured discussion on how public engagement could be further developed.

The Research Councils took responsibility for reporting actions around the continued public engagement. Laura Grant Associates reported on the discussions about the dialogue, and also reported the findings of an e-survey circulated to participants in the week following the workshop. This report is presented in Appendix 5.

Take home messages from the dialogue report

It was interesting that different groups and individuals picked up different 'take home messages' from the dialogue. Although this was the ice breaker activity, the groups quickly engaged with the task and the themes that emerged went on to be further developed through conversations later in the day. Key messages for researchers were:

- Public concern over scientists' motivations;
- The idea of natural vs. synthetic and discomfort at a mechanistic view of nature;
- When and how to do public engagement?
- The incremental nature of the research making it difficult to predict tipping points with strong social implications;
- That the public had a more positive view than expected about the scientists and their work.

Scientists need to 'bridge the gap' with the public over motivations

A few outcomes I didn't agree with – e.g. [the public] didn't like a mechanistic view [of nature], that's what engineering is!

A lot of the time it's incremental rather than fundamental. When will the incremental steps come to a tipping point?

Are the messages recognised as valid?

Participants felt disappointed that the public didn't think scientists already consider/take responsibility for the social implications of their work: it was pointed out that ideas about applications were written into funding proposals. Some also felt that researchers in synthetic biology were more likely to consider these ideas than those working in other disciplines. The discussion went on to expose a disconnect between the everyday work and the bigger picture, especially when applications are still far away. This made identifying implications tricky, as they were seen as being linked to applications rather than the research itself. Some felt this was problematic, others did not. Participants accepted that researchers have many different motivations both known and unknown.

I take issue with statements like that. It's like we've all been irresponsible and should sit on the naughty chair.

But impact comes from all the little bits put together. Motivations of different things in different corners might come together to produce a negative (or positive) result, so [it is] hard to predict

Compromise between personal interest, professional development, social good, economic benefit.

Influence on thinking about research

Researchers felt that the dialogue had made them think about public perceptions of their work but that other dialogues and interactions also contributed to this thinking, which is constantly changing anyway. Many were surprised by the lack of understanding of the scientific process among the members of the public that participated in the dialogue and this led to a call from some for better public understanding of how science is done. They also cautioned that if funders or others were to place too much emphasis on asking researchers to describe their motivations then this could lead to pressure for researchers to over-sell or 'hype' their work and its potential benefits. This was seen as potentially detrimental to the public interest, rather than helpful.

Informed by multiple 'dialogues' not just one

No won't change it because I had to think it through to get funding

Influence on thinking about public engagement

In contrast to impacts on their research, the workshop participants felt that the dialogue was likely to have a much stronger impact on their public engagement work. It was felt that the dialogue had stimulated useful conversations, and researchers were curious

about how this would feed back to the Research Councils or Government, and how public engagement would be supported.

Big issue of how to engage with the public is there sufficient money to do this? Is there time to do this? Do we have the skills?

The dialogue has helped me not to underestimate the public → will this change how you do public engagement? → what counts as effective public engagement. → mode remains the same tone is different.

Demonstrating considerations in future work

Two main challenges with public engagement were raised in this discussion. Firstly researchers questioned whether public engagement was a high enough priority for them to deliver the ongoing dialogue that public participants and others aspired to. While they felt engagement was important, having enough time to do it well was a significant barrier. Secondly, the interdisciplinary and non-hierarchical nature of synthetic biology was another challenge in terms of public engagement because it raised the question: who takes responsibility? Some felt that in a field or organization with a more hierarchical structure, the person at the top would take responsibility or clearly delegate this to others in the structure. This was not the case in the synthetic biology community, which was seen as having a more 'messy' structure than other fields. Finally, researchers were unclear about how they would provide evidence back to the public that consideration of public concerns had taken place.

Who is responsible in a highly interdisciplinary field? Can't predict when something that needs to be taken responsibility of will emerge. How can we keep an eye on it?

Areas for future engagement

When asked about areas for future engagement, researchers suggested the provision of clear and precise information about what synthetic biology is. Importantly, this should include complexity and uncertainties 'without trying to fudge anything'.

In the e-survey, some expressed concern about this focus on knowledge and felt that more should have been done to support discussion about different mechanisms for engagement:

I think everyone wants these programmes to do something important, but as yet they really haven't gone much further than the deficit model's unidirectional flow of expertise that natural scientists struggle to escape from. The event asked us to try and think about novel mechanisms and forms for engagement but gave us little in the way of example, guidance or justification.

E-survey findings

Overall, the workshop was well received by the majority of the 24 e-survey respondents. There were two or three participants who responded negatively to the workshop

overall, and a further two or three who gave mixed responses. However most were positive about the day and felt it was more focused than some of the other network events they had attended.

Participants valued the opportunity to network and share experiences and ideas during the workshop. Some felt that time constraints meant that discussions lacked the necessary depth or context, but generally participants acknowledged that a good amount of ground was covered in the time available.

Overall, an important event to ensure that the dialogue was not a dead-end. A good opportunity for networks to come together and explore the different work being done under the umbrella of 'public engagement' across the UK.

Discussions of the role of scientists began to be interesting and point up some complexities but there was little time to discuss further.

Some felt that time constraints meant that discussions lacked depth or context, but generally participants acknowledged that a good amount of ground was covered in the time available. Some felt the day could have been organized differently (e.g. longer presentations rather than posters, by sending out the questions for consideration beforehand) to make the most of the time available.

Discussions of the role of scientists began to be interesting and point up some complexities but there was little time to discuss further.

If the questions for the discussion of 'the role of scientists in synthetic biology' session were sent out beforehand then conversation may have warmed up a little faster

Five respondents would have liked greater depth and some additional stimulus for the discussions about public engagement. In our observations, while far from a disaster, these discussions seemed least constructive and this part of the day was rated lowest overall. A number of respondents felt that hearing about some public engagement (PE) good practice from outside the networks would have been beneficial.

When asked if they gained anything from attending, fifteen respondents reiterated the value of discussions and sharing experience and ideas. Five reported gaining a better understanding of the dialogue and its findings through the workshop, and four identified areas where they felt there was more to be done.

Some of the discussions around the table during the session whilst not necessarily focused on the question we were asked were illuminating. In this respect the anecdotal conversation with people from other networks was useful

I think it became clear that there is no more money available to continue the dialogue in this way and that we need to move to other approaches - probably as

part of future grants including PE. How the different networks approaches could be coordinated remains an open question that I think deserves a good answer.

The workshop had changed ideas about the dialogue for just under half of respondents. Some framed the change in thinking as a clarification, while others framed it in terms of new ideas.

It helped better understand the thinking behind the exercise. I still find this a difficult area in the context of synthetic biology, which is a very new science area, particularly with 'higher' organisms such as plants and crops.

Over half of respondents (14) said the recommendations from the dialogue will affect them 'a little'. Six said they would be affected 'a lot' and three 'not at all'. Interestingly, some respondents gave examples of how they plan to use the dialogue or its recommendations. Others felt that their work already encompassed the recommendations.

It hopefully will help as we organise / plan further public engagement events

The '5 questions' transcend synth biol - I will use them regularly when training researchers from any disciplines about PE. I will specifically use the dialogue in some training for our network members that we are running in March.

I will attempt to use Web 2.0 technologies to monitor the dialogue and share it my network and the others.

Some commented on the public aspirations and concerns that the dialogue had captured.

The report was interesting. It contained quite a few statements that I agree with, and quite a few that I disagree with. It therefore helped me question my stance on these issues.

For some, discussions had raised their own concerns about synthetic biology. This will be discussed in greater depth shortly.

I am still concerned about the mix of disciplines/science cultures. I find scientists rather overconfident about technology still. I worry about their need to sell their ideas to funders versus the reality of what are dealing with here!

Some respondents felt that the dialogue would influence their public engagement work, or had influenced their opinion about public engagement. Others felt it was too early for engagement.

Participating in dialogue process revealed to me the value of engagement and has encouraged me not to neglect this activity

Our work is too early stage to have meaningful dialogue

Beyond discussions on the day, it appeared that participants had had longer to reflect on what ongoing engagement might look like. A number of hopes and challenges were identified in the e-survey. Key points included who takes responsibility for public engagement and the exact mechanisms (including online) through which ongoing dialogue might take place.

Face to face meetings between scientists and the public, while valuable, are too expensive, inefficient and open to bias. How can we extend the reach of public engagement to wider audiences more cheaply and efficiently?

Comments in the dialogue about the incremental nature of research compared with the transformative nature of a field made me stop and think - and I'll use that when training/coaching others.

Participants suggested a number of resources that would be useful additions to the public engagement toolkit:

- Case studies and materials to help effectively communicate the science and engineering of synthetic biology;
- Examples of good practice in public engagement and advice on when different methods are appropriate, and with which audiences;
- Access to engagement specialists/facilitators for advice and support;
- A clear statement of the rationale for public engagement and/or creating a 'culture of engagement';
- A platform within the RCs to raise issues about ethics, motivations, clashes of culture and uncertainties;
- Guidance on online engagement approaches;
- Guidance on moving from dialogue findings to ongoing engagement;
- Videos;
- The five questions raised by the public to help scientists frame their engagement (see section 1.3).

Resources that meet some of these criteria have already been developed by the National Coordinating Centre for Public Engagement¹² and Sciencewise-ERC¹³.

A minority of e-survey respondents made comments related to mutual mistrust between scientists and social scientists that was not overt at the workshop. While most participants valued the diversity of expertise at the workshop and in the networks, some felt that scientists were unlikely to act in the public interest or that social scientists had a strong agenda to push public engagement onto the scientific community.

¹² www.publicengagement.ac.uk

¹³ [Reference/webpage no longer available – Feb 2016]

The scientists working on new synthetic biology applications are NOT going to be able to be dispassionate about the risks and benefits. It needs other personnel to talk about these aspects

Scientists are being completely marginalised by "social scientists" and "public engagement" professionals who are completely dominating all discussion. For those that continually espouse the need for a "dialogue" to be established, they simply refuse to listen to what scientists actually want from this, what they want to do, and how they wish for the interaction with the public to play out. Social scientists are hijacking this process. Mainly out of self interest.

These tensions may be typical of any diverse research community but it would be worthwhile exploring concerns further to mitigate the risk of the mistrust growing and undermining any ongoing engagement work. How can this be addressed?

Overall reflection on the embedding workshop

The embedding workshop was a valuable space for the synthetic biology community to reflect on the dialogue report. Some participants had not read the report prior to the workshop, so it represented much greater engagement with and learning from the findings than would have happened otherwise.

The workshop was not always a comfortable space. The dialogue report challenged participants' ways of working, which not all were open to. The e-survey revealed some mistrust between natural and social scientists in the group, which may have added further to sensitivities around the findings.

Despite this undercurrent among some, most participants were keen to continue and develop their public engagement work and valued the opportunity to come together and discuss this. The support of the synthetic biology community is crucial if the impacts on Research Councils' policies are to develop. The workshop was an opportunity for the Councils and the community to share their ideas and listen to the ideas of others. Some important questions about when engagement takes place, what form is appropriate and who it should be led by were raised. This will undoubtedly support both groups to continue the public dialogue and engagement as the field evolves.

7 Findings: Policy and other impacts

7.1 Policy influence

Unlike some other dialogues, the synthetic biology dialogue was not conducted to inform a specific review or a piece of new or changing legislation. Its findings have wider implications for the way that sciences and new technologies are developed.

Interestingly, when asked about policy influence from the dialogue, public, experts and stakeholders felt it was difficult to pinpoint. To some extent, this probably depends on some interviewees' assumptions about what policy influence could look like, e.g. that it would only count if it was felt in Parliament.

So I wondered whether having not been at the London event, I was wondering whether they had a similar sort of situation where you had a scattering of MPs and a scattering of MPs' researchers who'd feed back to MPs but not exactly banging down the doors of the Houses of Parliament. (Expert participant)

And this all got told at the workshop, it gets passed on about five or six times and I mean let's face it, and then the government decide. But it's the sub committees that decide, I mean the government decides but they've got a committee that decides for them haven't they. (Public participant)

Others felt that the influence of the report was related to the audiences it had reached.

For this document to have a life beyond the original community I think it's important and from the look of this it certainly went where it needed to go. I mean if you've got the science minister and the chief executives of the Research Councils, then you've pretty much done the job haven't you, if it's meant to be influencing policy. (Expert participant)

In contrast, stakeholders (especially those from the Research Councils) described a range of ways that the dialogue has influenced the way they work and potentially internal policies between and across councils. There were four key areas where the dialogue appeared to have made a difference:

1. Providing impetus to take the public concerns about synthetic biology to **regulators** via discussions with the Chief Scientific Advisor;
2. Catalysing and informing EPSRC's work on **responsible innovation** by linking to the dialogue through the Societal Issues Panel;
3. BBSRC are reviewing their approach to **ethics in grants** as a direct result of the dialogue, which in turn has created opportunities for the public engagement team to collaborate with colleagues that work on research funding;
4. Prompting an **RCUK proposal to Sciencewise-ERC** to fund research that draws together the findings across dialogues in areas of emerging technology.

Whether or not all of these four areas count as 'policy influence' is arguable, and some of these outcomes cannot be attributed to the dialogue alone (for example the work on responsible innovation was already underway). However they are an encouraging indication of the extent to which the messages from the dialogue have been taken on board. As one stakeholder pointed out:

I mean the simple fact that we are a policy making organisation, we set the funding strategy and so on and so forth is a fairly explicit statement of the fact that it will influence our policy because we've said that we're going to take the

findings seriously. Other people's policies, such as regulators and other policy makers, we've included them on the steering and oversight group in the hope that the report will be able to influence the bodies that they work for.

(Stakeholder)

Another played down these outcomes, and emphasised that this was the beginning of a much longer process.

Now we have something to build on but I don't think I had great expectations about policy would change instantly because of it or people would be totally aware about what synthetic biology is and it'll be out there for everybody to understand. I never expected that in the first instance. So it's like the beginning of a public iteration rather than sort of providing all the answers as such.

(Stakeholder)

The interviews also explored the mechanisms by which policy influence had happened or may happen in future. Several drivers and mechanisms were identified:

- Senior buy-in to the dialogue from both Research Councils at the outset;
- Active committees (Societal Issues Panel and Bioscience in Society Panel) within EPSRC and BBSRC respectively to drive the continuing work. It was pointed out that SIP is a very senior panel that carries a great deal of weight in the council, and that following the dialogue synthetic biology has been made a standing agenda item on BSS.
- One stakeholder outside the Research Councils noted the commitment of the staff in each council to embedding the messages from the dialogue;
- The nature of the Research Councils meaning they have close links to central Government notably BIS;
- The timing of the Craig Venter announcement and accompanying media flurry which provided a platform to talk about the dialogue;
- The fact that this was the first dialogue to be published following the appointment of the new science minister, combined with the fact that David Willetts took an interest in its findings;
- The resonance of some of the ideas in the dialogue with existing discussions going on in Research Councils e.g. responsible innovation;
- The scale of the dialogue – that with the size of the investment came greater drive to ensure the findings were listened to.

I think it's good that David Willetts seemed to be behind it because that was his first dialogue he was exposed to as Science Minister and to be honest for that purpose it could be any good dialogue.

In part it's because we have the commitment from our chief executive at the very onset that gave us a real strong mandate to take forward things that came out as a consequence of the dialogue.

I think the fact that Craig Venter was in the news a few weeks or months earlier must have helped raise its awareness.

(Stakeholders)

In addition to these policy-related ideas, some other outcomes were identified from the dialogue. Firstly, some interviewees felt that the dialogue should stimulate scientists to further engage members of the public with their work.

I think it should happen in a number of ways so I think there should be an encouragement of people like me to do what I am doing, to go out and actually engage with the public to do science festivals, go to high schools, all that sort of stuff.

(Expert participant)

Secondly, some interviewees felt that the international research community and regulators should be brought into the discussion. For one of the stakeholders, this was already being taken on by the international team at the organisation.

There is an international element to it and yet admittedly there must be a start point but actually at some stage one needs to start joining with the rest of the world.

(Public participant)

7.2 Work still to do

Many interviewees identified areas where there was work still to be done. In some cases this referred to the four key areas of work that the dialogue had influenced: engaging the regulators, EPSRC's work on responsible innovation, BBSRC's work on ethics in funding applications and the study to draw out learning from public dialogues on emerging technologies.

I suppose the regulators would probably say we haven't got anything very specific to regulate yet, but I would like to see them read the report and be asked to respond to it.

With emerging technologies there does seem to be this core set of questions, whether we need to go through it with every emerging technology or can we ask ourselves these questions without going into specifics?

(Stakeholders)

There were also some questions about whether and how the findings from the report would influence policies in the future.

What I'd like to know is when BBSRC makes its what does it call it – its sandpit discussions, where it comes out with ideas for more research to fund and things like this, I wonder if any of its decision making processes have in any way been influenced by the dialogue. And I wonder if any of the members of the public could be included, should be included, but I think the main thing is are these people taking this on board

(Stakeholder)

As well as these ideas, there was a strong aspiration from the interviewees that the process of dialogue should continue. This was an area that was seen as important yet challenging.

I think one of the hardest things we've committed to is involving members of the public.

I think there's an approach for Research Councils like in this dialogue where you actively are the facilitator in between and you commission the piece of work but in an ideal world it'd be really nice to be in a place where intuitively the research community think oh hang on there's something here where we need to get some sort of societal engagement to test out our own perspectives and sort of for it to happen as part of the process. So I think what I would like to see ideally is an embedded process of dialogue in how we commission research.

(Stakeholders)

The public interviewees did not necessarily see themselves being involved in an ongoing dialogue, although most were keen to be kept updated. One would have liked greater clarity on the purpose of the dialogue.

You've got email contacts, you've got telephone contacts, by all means you can communicate with me or continue that contact via the email to keep me aware

It's not really saying well what is the aim of this. It's [interview stimulus] saying that Research Councils meet, it's saying the discussion with government, parliamentary event, what I would like to see here is what is the goal of this dialogue, not there's a dialogue going on.

(Public participants)

So while continued dialogue was aspired to by some, exactly how this would be delivered and who would be responsible was unclear.

8 Findings: Cost-benefit

8.1 Actual costs

The total costs for the project were £334,000 (excluding VAT), made up as follows:

- £294,000 for the dialogue
- £6,000 for the embedding
- £34,000 for the evaluation

The Sciencewise-ERC contribution was £234,000 (including non-recoverable VAT as a project cost).

These costs exclude BBSRC and EPSRC staff costs, BBSRC and EPSRC costs for hosting oversight and steering group meetings, costs for time from oversight and steering group members, public participant time, time for other scientists and other experts taking part in events, costs of time for Sciencewise-ERC support (DES, evaluation, project management, BIS oversight).

In addition to these, members of the Steering and Oversight Groups provided their time outside of meetings in-kind. The Oversight Group met four times and included fourteen members whose time was not covered by the funds. One of the most active group members reported spending 55 hours on the project in addition to attendance at workshops and meetings. If we estimate the average time contribution to be eight hours at a modest academic daily rate of £400, this works out at an in-kind contribution of around £5600 in total. We do not have estimates of the time that Steering Group members spent on the project, but can assume that if this time is also factored in the overall value of the in-kind contribution of group members' time is around £10,000. This can be seen as a cost to these individuals, or as a benefit that the dialogue was able to leverage.

To put this into perspective, total funding for synthetic biology in the UK was estimated to have been between \$30 million and \$53 million (£18 million to £33 million) between 2005 and 2010¹⁴. Main funders are BBSRC, EPSRC and the Wellcome Trust.

8.2 Perceptions of value

Although perceived by some to be an expensive process, many assessed their view of the value of this spending in comparison with the amount of funding granted to research in this area.

...it's very expensive... But, relative to the amount of money that is going into synthetic biology research globally it's an absolute pin prick. (Stakeholder)

Although often not stated explicitly, there was the implication that it would be irresponsible to not gather public opinion when so much public money was used to fund research in this area. Interestingly, there was an assumption by one of the public interviewees that gathering public opinion about ongoing research would automatically be part of government budgets:

...investment isn't cheap on the research so this is just part of the budget I should think. The government will have a budget to spend, and companies will have a budget to spend on this research and this will just be a part of it, the public opinion about it. (Public participant)

¹⁴ *Trends in Synthetic Biology Research Funding in the United States and Europe* (2010) Synthetic Biology Project, Woodrow Wilson International Center for Scholars available at www.synbioproject.org/library/publications/archive/researchfunding accessed February 2011

Interviewees were asked if they felt similar data could have been gathered through other, perhaps less expensive methods, rather than the dialogue process. Most felt the dialogue was necessary and a valuable method, and cited the additional time for ideas to be introduced and thoughtful considered responses gathered as justification for this method being more useful than other snapshot market research techniques despite the additional expense.

There was some scepticism expressed by one or two expert or stakeholder interviewees who either personally dismissed dialogue as an approach, or who wondered about the motivations behind the dialogue, for example:

In terms of value for money, I mean a lot of value in these dialogues is the political value of being able to say we did one. (Expert participant)

However, even where interviewees were sceptical they generally acknowledged the benefits to the individuals involved in the process, citing the enjoyment and learning gained. A few interviewees alluded to the fact that this dialogue was the first of its scale in the area of synthetic biology and that because of this the expense was justified. One person suggested that the learning gathered through this dialogue would allow similar processes to be conducted in a more efficient way in the future.

Research Councils (and some other stakeholders) reflected that staff time had been underestimated when commissioning the dialogue.

The use of financial incentives was raised by a few interviewees. A couple of the public interviewees suggested that they would have attended for free as they found the process very interesting (although they found it difficult to confirm whether they would have actually signed up without the incentive as they were not told the topic of discussion at recruitment stage). The issue of responsibility for communicating the science to the public came up with one public participant questioning the need for payment for the expert participants:

...this is just my opinion but the scientists, if they really, really wanted to get their point across then they could have given their time for free as well. If it's something that they truly believe in that they can do this and make big breakthroughs, then I would want the world to know. (Public participant)

In considering the value for money gained from the dialogue some interviewees wondered about the extent to which the contractors' brief had included work post-report launch in order to maximise impact. It was suggested that this may have been a useful allocation of budget, especially when 'value' is deemed to depend on who takes notice of the report. As one expert participant pointed out:

...getting people to take notice of it [the report] is quite an expensive thing as well I should imagine. (Expert participant)

This point is especially pertinent in the current economic climate. For example, the short printed booklet summary of the dialogue report which was produced for the embedding workshop is not intended to be circulated more widely in print due to budget restrictions within the Research Councils.

9 Conclusions and recommendations

We have used the evaluation questions identified in Section 2.1 to organise our conclusions.

Evaluation question 1: To what extent did the project meet its aim and objectives?

We feel that the follow-up evaluation has gathered additional evidence against several of the dialogue objectives.

- Allow institutional learning about dialogue processes, including the diversity of views, aspirations and attitudes that exist with reference to scientific, economic and social policy and economic aspects of new technologies.
- Raise awareness and capacity within the Research Councils, policy makers and the scientific community of aspirations, concerns and views in relation to synthetic biology and the importance of dialogue.

Section 4 describes how expert participants and stakeholders learned about public views and dialogue through their involvement in this process. Section 7 on policy influence describes how some of these insights are being taken on board at an institutional level within the Research Councils. Working across councils appears to have been a useful mechanism to stimulate discussion (at all levels) and reflect on this learning, with different councils taking action in different areas.

- Improve on what is seen as good practice and thus provide a foundation on which broader future engagement can build and inform the development of a longer term project of engagement.

The embedding workshop was an innovative addition to the dialogue which gave the report greater reach within the synthetic biology community, as well as providing a space for dialogue between that community and the Research Councils. It also represented progress against the part of the objective related to ongoing engagement, for which there appeared to be a strong level of enthusiasm. This is a long-term objective, but a solid start has been made.

Overall, the dialogue aimed to:

- 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.

The follow-up evaluation has yielded evidence against the second part of the aim. The dialogue findings have been discussed in a number of arenas within the Research Councils, Government and the synthetic biology community. There is evidence that the findings from the report are being translated into different formats, with different messages highlighted for different audiences. For example the overview report aimed at experts in the field, or the letter focusing on regulatory issues for the chief scientific advisor. The Research Councils have identified where each council can adapt its ways of working or policies to better reflect public interests. Work in these areas is now ongoing.

Evaluation question 5: To what extent are the dialogue's outcomes specific to synthetic biology or related to general trends across emerging technologies?

The findings from the dialogue were applicable much more widely than to synthetic biology alone, with potential implications across emerging technologies. While some researchers at the embedding workshop felt that this meant they were too general to be useful, they appear to have resonated within the Research Councils. The public aspirations expressed through the dialogue, especially the five questions, were seen as challenging to the Research Councils. However a joint response has been agreed and work is now underway to address the challenges within both BBSRC and EPSRC. Recommendations focused more closely on synthetic biology may not have delivered the same level of impact.

Evaluation question 7: What mechanisms were used to maximise policy impact (e.g. direct contact between public participants and policy makers) and how effective were they?

There was little direct engagement between public and policy makers, but a number of other mechanisms promoted influence, some outside the control of the RCs and others. In summary, the mechanisms were:

- Structures in place at the **Research Councils** e.g. senior buy-in, active and influential committees (e.g. SIP, BSS), RC staff commitment, the nature of the RCs as policy making organisations themselves with close links to central Government.
- The resonance of the dialogue messages with **discussions that were already going** on in Research Councils, that allowed other areas of work to be joined up, e.g. responsible innovation.
- **External factors** that raised the profile of the dialogue: the report was launched shortly after Venter's announcement and it was also the first dialogue to be published following the appointment of the new Science Minister, who took an interest in the work (prompted by the Research Councils).

For future dialogues, identifying which of these types of drivers can be employed to maximise policy and other influences might be beneficial.

There was a perception among some interviewees that different cultures within the two lead Research Councils supported or limited the extent to which the dialogue findings

could be taken forward. EPSRC was described by some as more innovative in this area, while BBSRC were seen as more cautious, but also as having a longer history with dialogue-type public engagement. For both councils, the public engagement staff were seen as positive catalysts for change. A few interviewees thought that public engagement staff were located solely in the communications department at BBSRC, compared to EPSRC where they were seen as more embedded in various parts of the organisation including at senior level. One scientist also felt that BBSRC were decreasing their funding commitment to synthetic biology while EPSRC were increasing theirs.

Interviewees from the Research Councils (and some others) did not share these views. They acknowledged that the two councils have different ways of working, but felt that these were complementary approaches that were valuable for sharing learning. It was also noted that BBSRC has an integrated communications and public engagement unit, rather than one unit being part of a larger department. Both councils also have high level strategy panels (BSS and SIP mentioned earlier) which are involved in acting on the dialogue recommendations.

It is natural that different organisations will have different cultures and it is interesting that the evaluation has revealed the different ways in which these cultures are perceived within and outside the organisations themselves. These cultures and perceptions should not be neglected when exploring the nature and extent of any influence on policy and practice.

Evaluation question 8: Did the process and results of the dialogue have an impact on policy? In what way and to what extent?

Findings in this area were interesting. Stakeholders and others were reticent to state that policy had been influenced, but four clear outcomes emerged from the dialogue:

1. Providing impetus for Research Councils to take the public concerns about synthetic biology to **regulators** via discussions with the Chief Scientific Advisor;
2. Catalysing and informing EPSRC's work on **responsible innovation** by linking to the dialogue through the Societal Issues Panel;
3. BBSRC are reviewing their approach to **ethics in grants** as a direct result of the dialogue, which in turn has created opportunities for the public engagement team to collaborate with colleagues that work on research funding;
4. Prompting an **RCUK proposal to Sciencewise-ERC** to fund research that draws together the findings across dialogues in areas of emerging technologies.

Whether or not all of these four areas count as 'policy influence' is arguable, and some of these outcomes cannot be attributed to the dialogue alone (for example the work on responsible innovation was already underway). However they are an encouraging indication of the extent to which the messages from the dialogue have been taken on board.

At this stage of the process, ways in which the dialogue had or might influence other Research Councils and/or central government were unclear.

Evaluation question 9: What did scientists/engineers/Research Councils/policy makers and other stakeholders learn about...

- **Public attitudes, aspirations and concerns regarding synthetic biology?**
- **Dialogue tools and processes?**
- **The advantages and limitations of public engagement with these types of issues?**
- **Any other aspects?**

There was considerable learning about public views, as would be expected for a dialogue of this type. Interestingly, one scientist felt that attending the workshops and interacting with members of the public was more valuable in this regard than reading the report.

A strong message from this evaluation is the importance of continuing the dialogue. In the cost-benefit analysis, judgements on the value of the dialogue, especially in terms of its potential to impact on future policy, depended on whether the findings were listened to. Many interviewees (public, expert and stakeholder) also tended to caveat their opinions of 'success' in this way, suggesting that an enjoyable and 'successful' dialogue process was all very well but was only really valuable if its findings were listened to and acted upon where necessary.

Exactly what the ongoing public engagement could look like was explored in the embedding workshop. The issues that were raised are discussed in Section 6.4.

From our interviews, it appeared that the Research Councils were looking to the research community to continue the dialogue, and the research community were looking to the Research Councils to direct and support the engagement. The exact nature of these roles is important if the dialogue is to continue and the full potential value of the investment to date realised.

A further challenge identified in the interviews was how to keep the public involved in this dialogue. Public participants we interviewed had mixed expectations about this, but there are some basic processes that can be improved e.g. effectively communicating why contact details are required and managing expectations about further involvement (e.g. some participants were expecting to hear about online engagement).

The dialogue offered a rich opportunity for Research Councils and others to learn about the challenges of doing dialogue well both during the period of public engagement and in terms of embedding the recommendations afterwards.

Evaluation question 10: What were the outcomes for the various participants (including members of the public, scientists, engineers, policy makers and Research Councils) and how did these compare to the outcomes anticipated at the start of the project?

Public participants found the process interesting and reported learning about synthetic biology, although when prompted few felt confident describing exactly what it was. They had entered the process with few expectations and were satisfied with the audiences the report had reached. In the interviews, shifts in attitude appeared less pronounced compared to the initial questionnaire feedback, which suggests that these outcomes diminish over time. However several interviewees described taking a new interest in synthetic biology and science more widely that had been sustained until the time of the interviews (although this may also have been a factor in sample members agreeing to participate in this stage of the evaluation). This interest took the form of web searches on synthetic biology or other topics, taking an interest in relevant news items that may not have registered before, feeling able to 'see through the nonsense' that can be published about science in some media, and continuing to discuss the topic with friends and family.

Expert participants also enjoyed the process as an opportunity to listen to public views and develop their public engagement work. Few had been involved in this type of public engagement before. Outcomes for the wider scientific community have been discussed in response to the previous question, and there is no doubt that creating the space for discussion of the dialogue through the embedding workshop helped the work have greater impacts on scientists and engineers.

Outcomes for policy makers and Research Councils have been discussed in the section on policy influence.

10 Recommendations

Evaluation question 11: What learning and good practice should be taken forward for future dialogues?

In addition to the learning points captured in our interim evaluation (see Appendix 1) this study has enabled us to consider longer term impacts and learning by assessing the activities following a dialogue. Key learning and good practice points are:

- Consider data protection issues early to enable as many participants as possible to provide contact details to stay informed about the dialogue.
- Manage participants' expectations about continued dialogue.
- Think about dissemination and embedding of results at the commissioning stage. Identify channels and allocate funds as appropriate, but do not plan too closely

- as it is important to have flexibility to respond to the dialogue findings. The embedding workshop was a good example of how this can be done effectively.
- Encourage as many experts or stakeholders as possible to attend workshops (within the limits set by the dialogue contractors) by continuing to offer travel costs. For one expert participant, attending the workshops was more valuable in understanding public views than reading the report. In addition, consider presenting outcomes in different media as well as a written report.
 - When engaging experts, ensure they are briefed on the structure of the dialogue as a whole, rather than the public engagement aspect alone. This will help them contribute more effectively as well as make more sense of the results of the dialogue.
 - Continue to work with the scientific community to foster understanding of what a dialogue process is and how the findings can be interpreted. Creating space to discuss these is helpful.
 - Consider and communicate what is meant by ‘policy impact’, especially in the case of upstream dialogue. What does success look like for engagement in an emerging field such as synthetic biology? The dialogue report called for culture change within the RCs and scientific community. How can this be evidenced?
 - Identify which mechanisms might maximise policy influence and make the most of them. These include existing structures and timely opportunities such as related media stories.
 - The issues of support, recognition and reward for public engagement among academics will limit the extent to which they are able to prioritise continued public engagement. Research Councils and others should be mindful of these issues in their expectations of researchers, and work to offer support and reduce barriers where possible. Of course considerable work is already underway in this area through the Beacons for Public Engagement¹⁵, the funders’ Concordat¹⁶ and other initiatives.

In addition to these learning points, the follow-up evaluation has identified three questions related to ongoing dialogue about synthetic biology:

1. How will the public know they have been listened to?
2. What are the roles and responsibilities for researchers, Research Councils and others (e.g. public engagement practitioners) for continuing the dialogue? How will this be funded and supported?
3. How will learning be taken to other Research Councils and research communities, including internationally?

¹⁵ <http://www.publicengagement.ac.uk/about/beacons>

¹⁶ [Reference/webpage no longer available – Feb 2016]

Appendix 1: Summary of interim evaluation findings

Learning points were identified under a number of headings:

Learning points: workshops

I believe the workshop really had a blend of people from all walks of life and it was well structured and timed (Public participant)

- A large number of groups and effective sampling supported a valuable range of views and helped mitigate the impact of a minority of groups that did not engage fully;
- Video ethnography (short films made by scientists about how they work) was highly effective and had a strong impact, however videos of presentations were less effective;
- Public and expert participants valued face-to-face interactions highly;
- Public influence on workshop design is a valuable aspiration, although needs can be anticipated to some extent to aid planning;
- A greater focus on engaging ways to communicate the scientific principles at the core of synthetic biology may have empowered public participants still further;
- The focus group approach built trust between participants, but inherent in this method is the establishment of social norms that may have limited the expression of some views;
- The reconvened workshop was an effective means of checking the dialogue findings with public participants, although only a relatively small number were able to be involved;
- Research Councils and others should remain realistic about the advantages and limitations of dialogue. Including these in balanced communication about the dialogue will help avoid any criticism of the method (for example from perspectives that value quantitative over qualitative approaches) undermining the findings.

Learning points: public participants

Initially I was unaware of this concept. But now I can quite well talk about this with my family and friends. (Public participant)

- Participants felt the process was worthwhile and many are keen to remain involved in dialogue about synthetic biology;
- The extent to which participants feel their views are listened to will affect their perception of the process;
- Plans for continued engagement should be agreed and communicated to participants.

Learning points: expert participants

Often in these circumstances you get asked questions somehow you never got round to asking yourself. (Social Scientist, Workshop 3)

- Experts found their experiences worthwhile;
- Scientists were pleased that the public were broadly supportive of their research;
- Social scientists valued participating in a process they might usually critique and the opportunity to see some of the methods in action;
- Experts were conscious of their capacity to introduce bias and some might have appreciated more support or advice on this ahead of the workshops;
- A tool such as a short film giving an insight into a dialogue could be a useful briefing aid;
- Encouraging experts to prepare plenary input beforehand could limit the risk of spontaneous misleading remarks;
- The roles of experts and observers (especially experts attending in the capacity of observers) should be clarified during workshops, perhaps creating a space where observers can highlight misconceptions that moderators may wish to address without interjecting in group discussions;
- A less pressured timescale and/or more effective planning overall may have allowed exploration of further ways to include industry and NGO voices (as well as through the actors).

Learning points - Oversight

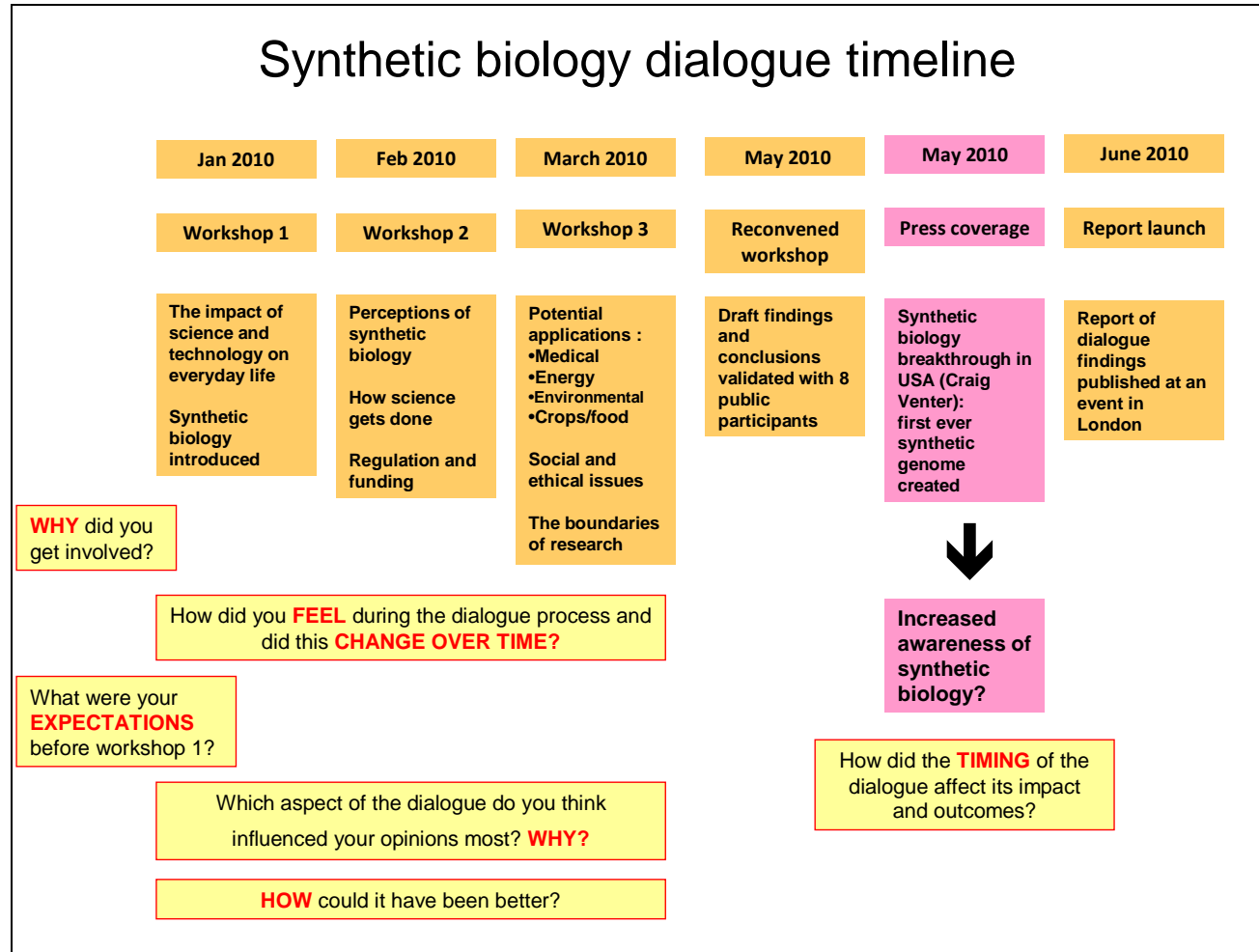
Because these are such important issues people want that [interpretation of public] opinion to be right and want to be sure about what the public think and that makes them a little bit wary about anything innovative. (Interviewee)

At this stage of the evaluation, with more follow-up work to do with public and expert participants, the issue of oversight is where we have the most detailed findings.

- Management and Oversight did not always run smoothly, although impacts on the dialogue workshops themselves were modest;
- The Oversight Group needed longer to build trust. It would be useful to explore ways that this group could have greater ownership over the dialogue principles, which were passed on to the Oversight Group from the Steering Group;
- Diversity in the membership of the OG was seen as a strength, but extra time and resource is required to make any process inclusive;
- Research Councils (especially BBSRC) developed a stronger role as the dialogue progressed. More planning and direction from the RCs on how the process will be managed and the respective roles in decisions for SG, RCs, OG and contractors would be valuable in future;
- Committees tend to be conservative, how does this link with innovation?

- Oversight Group members dedicated considerable time to the dialogue, which was valuable;
- Consider ways to better manage discussions over email;
- Capture and share learning among Research Councils and others about this aspect of the dialogue.

Appendix 2: Follow-up telephone interview stimulus



Synthetic biology dialogue timeline

HOW MANY outcomes were you aware had happened?

Report launch

WHAT did you anticipate would happen next?

July 2010

Government speeches

David Willetts, Science minister, refers to dialogue findings in two government speeches

Oct 2010

Research councils meet

Chief Executives of BBSRC & EPSRC meet. Joint letter sent out in response to dialogue findings

Oct 2010

Discussion with Government

Research Councils talk to:
•Sir John Beddington, Govn chief Scientific Advisor
•Department of Business Innovation and Skills

Dec 2010

Parliamentary event

Dialogue findings shared with MPs

Jan 2011

Follow up evaluation

This interview, amongst others!

Tracking use of report in professional communities

Understanding impact on policy

Feb 2011

Embedding workshop

Event with science professionals

Reflecting on key messages from dialogue

Sharing best practice in, and developing a toolkit for, public engagement

What does it mean for future research?

What about impact and outcomes **FOR YOU?**

What did you **LEARN** about

- synthetic biology;
- other people's views;
- dialogue;
- public engagement?

Has anything **CHANGED** in your:

- awareness and understanding;
- interests;
- opinions and attitudes;
- behaviour?

Appendix 3: Citations data

ID	Label	Citation	Who	Where
1	Dialogue (report) (generally)	Dialogue (report) (generally)		
2	Dialogue report (electronic)	Dialogue report (electronic)	BBSRC	BBSRC website
100	Dialogue report (electronic)	Dialogue report (electronic)	Sciencewise-ERC	Sciencewise-ERC website
3	Dialogue report (printed)	Dialogue report (printed)	BBSRC / EPSRC / Sciencewise-ERC	Via Research Councils distribution
4	Report Launch Westminster event	Report Launch event	BBSRC / EPSRC / Sciencewise-ERC	Westminster event
5	David Willetts speech at RI	David Willetts speech at RI	David Willetts	Royal Institution
6	Transcript of David Willetts speech at RI	Transcript of David Willetts speech at RI	David Willetts	BIS website
7	EPSRC report launch press release	New report reveals public's views on synthetic biology	EPSRC	EPSRC website - News section
8	Science in Parliament report launch article	New report reveals public's views on synthetic biology	Matt Goode / Nancy Mendoza (BBSRC)	Science in Parliament
9	University of Copenhagen news item re report launch	New report reveals public's views on synthetic biology	Kasper Kistrup	Univ of Copenhagen website Synbio - news
10	Nature 465 article 17.06.2010	Nature World View column: Talking the talk	Colin Macilwain	Nature 465 (online)
11	Nature 466 article 04.08.2010	Nature World View column: Not by experts alone	Daniel Sarewitz	Nature 466 (online)
12	New Scientist article 20.06.10	British public 'relaxed' about synthetic life	Staff writer	New Scientist (online)
13	New Scientist article 01.07.2010	Artificial life: let the people decide	Tom Wakeford and Jackie Haq	New Scientist (online)
14	New Scientist letters 04.08.10	Synthetic Biology	Helena Paul and Ricarda Steinbrecha	New Scientist (online)
15	Lord Winston dialogue usefulness question. House of Lords Sci & Tech committee	Question on government support for dialogue	Lord Winston	Minutes of House of Lords Sci & Tech committee
16	David Willetts' response to dialogue usefulness question. House of Lords Sci & Tech	Response to Lord Winston's Q stating usefulness of this dialogue	David Willetts	Minutes of House of Lords Sci & Tech committee

	committee			
17	David Willetts reponse to public trust in science question. House of Commons Sci & Tech committee	Response to question: "Is there anything you think you can do specifically as Science Minister? Have you given yourself a metric that by the end of four years that trust in science and the public's view of GM foods will have changed?"	David Willetts	Minutes of house of commons Sci and Tech committee
18	Juliet Pascal (ex-BMRB) LinkedIn profile	Linked in profile	Juliet Pascall	Linkedin.com
19	SCN (Bristol Univ) dialogue write up	Towards Synthetic Biology from the Bottom Up	Maggie Leggett	Synthetic Components Network, Bristol university website
20	Durham university article	New report launched on public attitudes to synthetic biology	Durham University	Durham University website
21	BBC news article	Artificial life 'needs regulation' - public survey says	Pallab Ghosh	BBC news (Science & Environment)
22	BioNews 563 article	Public wants synthetic biology regulated, survey says	Nishat Hyder	BioNews 563
23	BioNews 566 Questions to Dr. Julian Huppert MP	Ten questions for Dr Julian Huppert MP	Dr Vivienne Raper	BioNews 566
24	Daily News and Analysis India news	People want say in debate over synthetic life	ANI (agency)	Daily News and Analysis India
25	MATEs (University of Sheffield) news	BBSRC Synthetic Biology Dialogue	The University of Sheffield	The University of Sheffield website
26	RosBNet wiki (Univ of Oxford)	RosBNet wiki	RoSB network	hosted by Oxford University
27	SCN (Bristol Univ) report launch news	New report reveals public's views on synthetic biology	Synthetic Components Network	Synthetic Components Network, Bristol university website
28	SCN (Bristol Univ) response letter news	Research Councils' respond to synthetic biology public dialogue	Synthetic Components Network	Synthetic Components Network, Bristol university website
29	Research Council's joint response letter	Research Council's joint response letter	BBSRC / EPSRC	BBSRC website
30	Dialogue project page (BBSRC)	Dialogue project page (BBSRC)	BBSRC	BBSRC website
31	BBSRC report launch press release	New report reveals public's views on synthetic biology	BBSRC - press release	BBSRC website (news section)

32	BBSRC joint response press release	Joint BBSRC/EPSRC response to Dialogue report	BBSRC - press release	BBSRC website (news section)
33	EPSRC joint response press release	Synthetic biology public dialogue joint response	EPSRC press release	EPSRC website - News section
34	Embedding workshop	Embedding workshop	BBSRC / EPSRC	Mercure Holland House hotel, Bristol
35	PHG Foundation report news	Report on synthetic biology dialogue	Dr Sowmiya Moorthie	PHG Foundation website
36	PHG Foundation news re ESRC Genomics Forum	Views on synthetic biology	Dr Philippa Brice	PHG Foundation website
37	IHRR blog on report	New study on public attitudes to synthetic biology	IHRR (incl's Matthew Kearnes)	Institute of Hazard, Risk & Resilience blog
38	Strategic Science project (Durham Univ) news	The BBSRC/EPSRC Public Dialogue on Synthetic Biology report was launched on Monday, 14 June 2010.	Dr Matthew Kearnes	Strategic Science project page (Durham university)
39	Rathenau Instituut article, Netherlands	Synthetische biologie: Nieuwe technologie		Rathenau Instituut (Netherlands)website
40	Sciencewise-ERC News	Sciencewise-ERC News (online)	Sciencewise-ERC	
41	Sciencewise-ERC dialogue project page	Dialogue project page (Sciencewise-ERC)	Sciencewise-ERC	Sciencewise-ERC website
42	Tom Wakeford blog	A knowledge economy needs Big Society science	Tom Wakeford	Research blogs
43	Whose Science event at Dana Centre, Science Museum London	Whose Science?	Tom Wakeford/Patrick Middleton/Karen Folkes and others	Dana Centre, Science Museum London
44	Genome Web Daily News	UK Workshops on Syntehtic Biology Reveal Fascination, Worries	a GenomeWeb staff reporter	Genome Web Daily News
45	BioEssays editor's article	Synthetic biology: A tight-rope walk between humility, ambition and language	Andrew Moore, Editor-in-chief	BioEssays vol 32, issue 8, page 645
46	Government & Public Sector journal public engagement article	Why We Need a Greater Diversity of Experts for Effective Public Dialogue	Suzannah Lansdell	GPSJ online (Government & Public sector journal)
47	Parliamentary and Science Committee meeting record	Parliamentary event meeting record		Parliamentary and Science Committee
48	Westminster event	Synthetic biology dialogue What is the public perspective	various	Westminster
49	SCN (Bristol Univ) news item re ESRC Genomics Forum	Synthetic Biology gets another wary welcome	Synthetic Components Network	Synthetic Components Network, Bristol university

				website
51	SCN (Bristol Univ) news item re US Bioethics	US Bioethics Committee gives Synthetic Biology the green light	Synthetic Components Network	Synthetic Components Network, Bristol university website
52	Sciencewise-ERC news item re Willetts RI speech	David Willetts, Minister for Universities and Science, on transparency and public dialogue		Sciencewise-ERC website
53	Soft machines blog re David Willetts, Science and Society	David Willetts on Science and Society	Richard Jones	Soft machines blog
54	Minutes of House of Commons GMO public consultation	Response to a question about projects capturing public attitudes to GM crops	David Willetts	Minutes of house of commons Genetically Modified Organisms: Public Consultation
55	Susan Soulsby presentation to 2nd RosB networkworkshop	Susan Soulsby presentation to 2nd RosB networkworkshop	Susan Soulsby	St Anne's College, Univ of Oxford
56	Julia Moore request for report copies	Request for hard copies of report		
57	USA House of Representatives report	ENGINEERING THE CLIMATE: RESEARCH NEEDS AND STRATEGIES FOR INTERNATIONAL COORDINATION	USA House of Representatives	
58	BBSRC BSS meeting(s)	BBSRC biosciences in society panel (BSS)	BBSRC BSS	BSS meeting(s)
59	EPSRC SIP meeting(s)	EPSRC societal issues panel (SIP)	EPSRC SIP	SIP meeting(s)
60	BBSRC staff seminar	BBSRC internal seminar for staff to disseminate report	Emma Longridge and Patrick Middleton	BBSRC
61	Report overview flyer	Overview of report (hard copy)	BBSRC	BBSRC
62	RCUK public consultations	Research Councils UK	RCUK	Public Consultations webpage
63	US Presidential Commission for the study of Bioethical Issues report	NEW DIRECTIONS The Ethics of Synthetic Biology and Emerging Technologies	Presidential Commission for the Study of Bioethical Issues	
64	House of Commons Sci & Tech committee	Question on government support for dialogue	Lord Winston	House of Lords Sci & Tech committee
65	House of Commons Sci & Tech committee	Response to Lord Winston's Q stating usefulness of this dialogue	David Willetts	House of Lords Sci & Tech committee
66	House of Commons Sci & Tech committee	Response to question: "Is there anything you think you can do specifically as Science Minister? Have you given	David Willetts	House of commons Sci and Tech committee

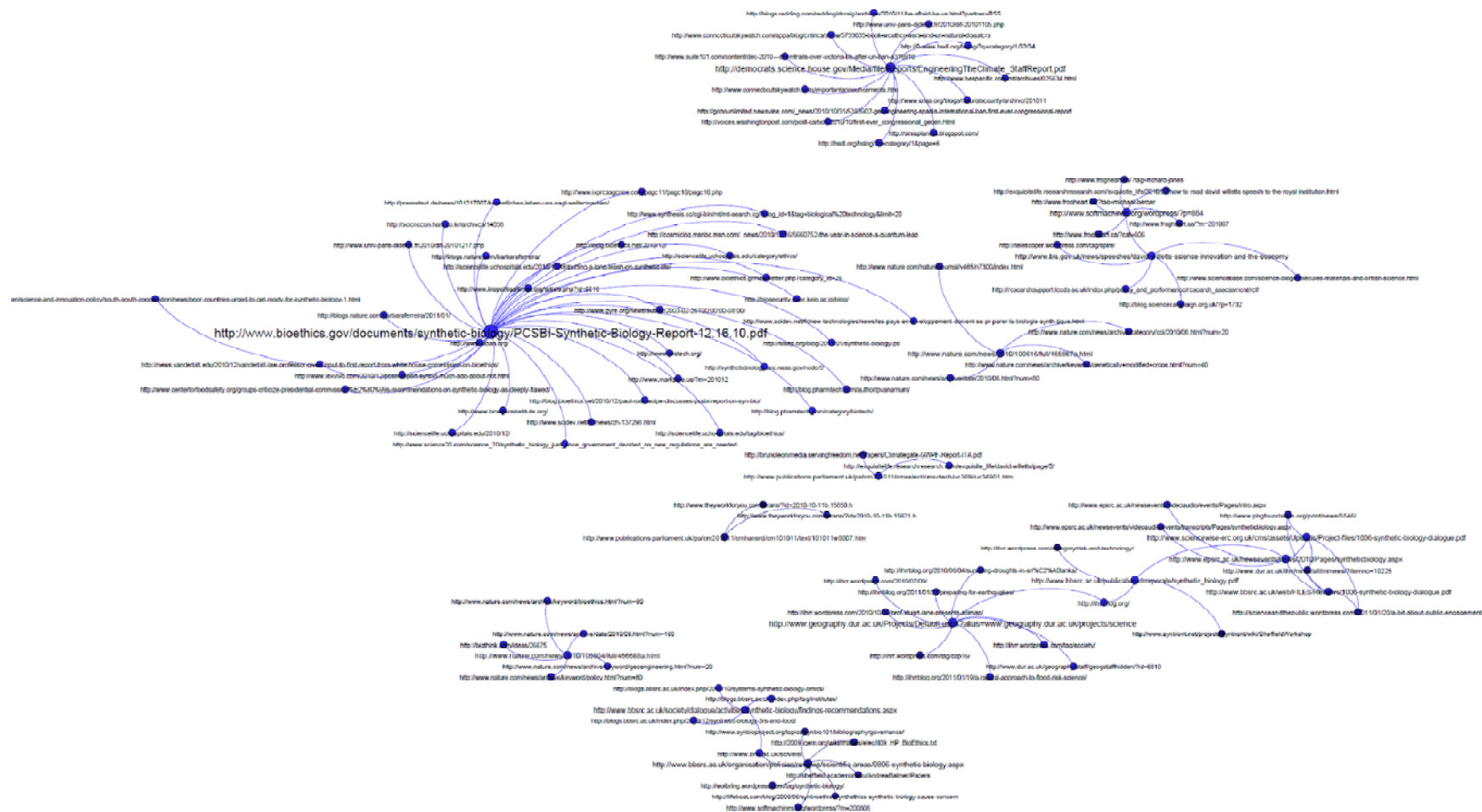
		yourself a metric that by the end of four years that trust in science and the public's view of GM foods will have changed?"		
67	Video of House of Commons Sci & Tech committee	Question on government support for dialogue	Lord Winston	video of House of Lords Sci & Tech committee
68	Video of House of Commons Sci & Tech committee	Response to Lord Winston's Q stating usefulness of this dialogue	David Willetts	video of House of Lords Sci & Tech committee
69	Video of House of Commons Sci & Tech committee	Response to question: "Is there anything you think you can do specifically as Science Minister? Have you given yourself a metric that by the end of four years that trust in science and the public's view of GM foods will have changed?"	David Willetts	video of House of Commons Sci & Tech committee
70	New Scientist 2766 article	Artificial life: let the people decide	Tom Wakeford and Jackie Haq	New Scientist (print) Magazine issue 2766
71	New Scientist 2765 article	British public 'relaxed' about synthetic life	Staff writer	New Scientist (print) Magazine issue 2765
72	New Scientist letters 04.08.10	Synthetic Biology	Helena Paul and Ricarda Steinbrecha	New Scientist letters (print) Magazine issues 2772
73	Nature 465 article 17.06.2010	Nature World View column: Talking the talk	Colin Macilwain	Nature 465 (print)
74	Nature 466 article 04.08.2010	Nature World View column: Not by experts alone	Daniel Sarewitz	Nature 466 (print)
75	Minutes of House of Lords during motion re Nanotechnologies report	Comment on the motion to take note of the Nanotechnologies and Food: Science and Technology Committee Report	Lord Crickhowell	Minutes of House of Lords debate
76	Comment in House of Lords during motion re Nanotechnologies report	Comment on the motion to take note of the Nanotechnologies and Food: Science and Technology Committee Report	Lord Crickhowell	House of Lords debate
77	Video of House of Lords during motion re Nanotechnologies report	Comment on the motion to take note of the Nanotechnologies and Food: Science and Technology Committee Report	Lord Crickhowell	video of House of Lords debate
78	Risk Analysis report re EPSRC Responsible Innovation pilot	Responsible Innovation: A Pilot Study with the UK EPSRC	Richard Owen and Nicola Goldberg	Risk Analysis, Vol. 30, No. 11, 2010 (online)
79	Risk Analysis report re EPSRC Responsible Innovation pilot	Responsible Innovation: A Pilot Study with the UK EPSRC	Richard Owen and Nicola Goldberg	Risk Analysis, Vol. 30, No. 11, 2010 (print)
80	The Biochemical Society	A bit of rebranding or something new and inspiring?	Derek Woolfson and	The Biochemist Vol 33 No 1

	magazine article	Synthetic Biology	Elizabeth Bromley	(online)
81	The Biochemical Society magazine article	A bit of rebranding or something new and inspiring? Synthetic Biology	Derek Woolfson and Elizabeth Bromley	The Biochemist Vol 33 No 1 (print)
82	Sciencewise-ERC Dialogue Bulletin	Synthetic biology: What does the public think?	Sciencewise-ERC	Sciencewise-ERC Dialogue Bulletin
83	Involve article on PE	The Homeopathic Theory of Public Engagement	Involve	Involve
84	Sciencewise-ERC / Involve paper on PE	What the public say: Public engagement in national decision-making	Simon Burall and Thea Shahrokh (Involve/Sciencewise-ERC/BIS)	Involve
85	Synbio Standards network	BBSRC/EPSRC Synthetic Biology Dialogue, June 2010	Sythetic biology standards network	syn bio standards website
86	Sciencewise-ERC Q&A to expert dialogue participants	Focus on Experts: Q&A	Sciencewise-ERC	Sciencewise-ERC website
87	Sciencewise-ERC news	Evaluations provide insights on effective public dialogue in science	Sciencewise-ERC	Sciencewise-ERC website
88	Interim dialogue evaluation report	Interim dialogue evaluation report	LGA	BBSRC website
89	Brian Johnson talk in Copenhagen	Brian Johnson talk in Copenhagen	Brian Johnson	Copenhagen
90	Brian Johnson talk at network meeting	Brian Johnson talk at network meeting	Brian Johnson	network meeting
91	Scottish parliament event	Scottish parliament event		Scottish parliament
95	Jane Gregory talk to Univ of Leeds philosophy department	Jane Gregory gave departmental seminar to University of Leeds philosophy department 'relationship between innovation, policy and public engagement with science'	Jane Gregory	University of Leeds
96	Sciencewise-ERC News		Sciencewise-ERC	

Report horizon

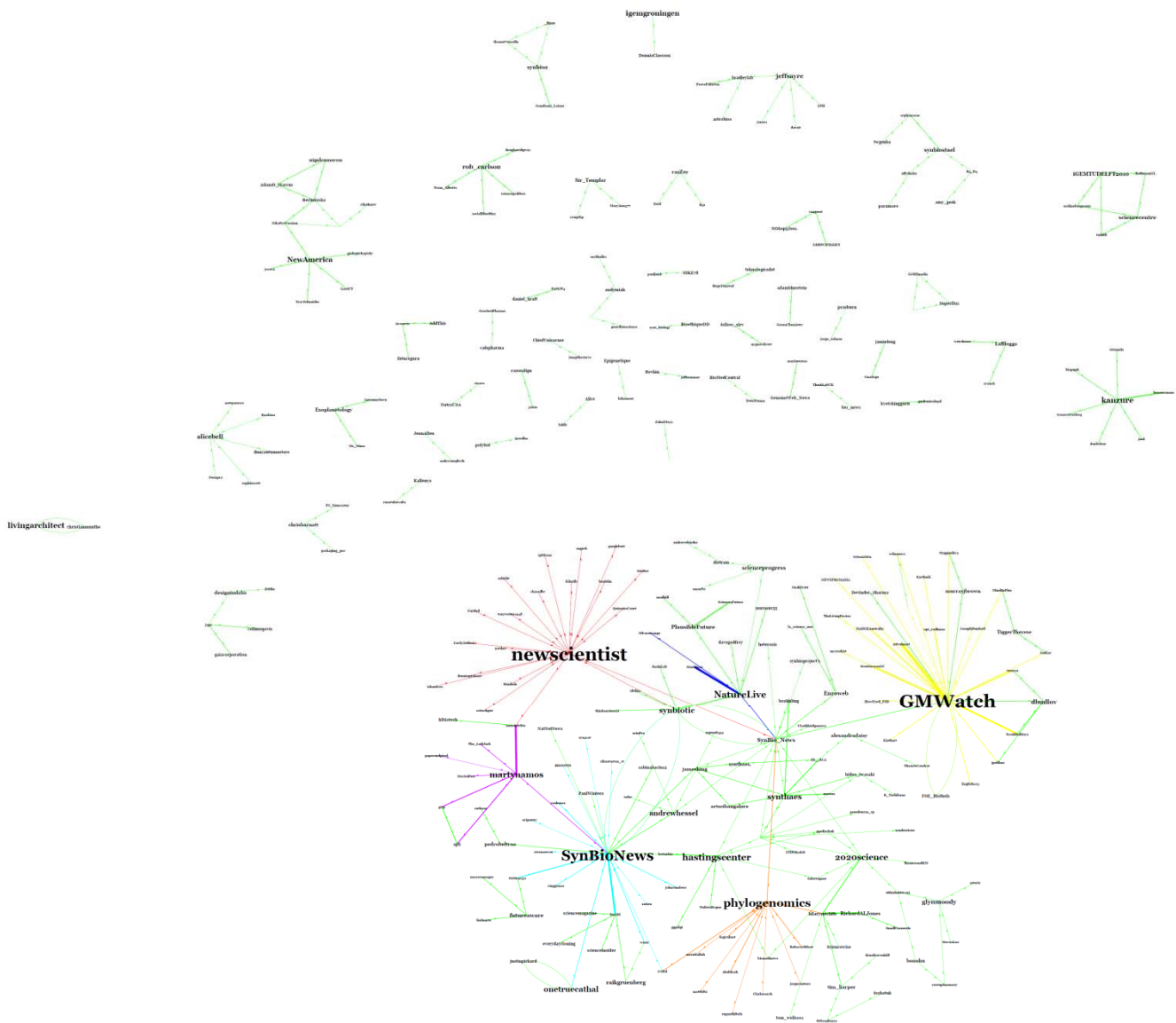
This shows the additional sources which linked to the webpages which appear in the citation list. Probably the most interesting part of this image is the connection between Sciencewise-ERC, BBSRC and Geography at Durham. The horizon around the other URLs in the citation report do not link up to show a wider network. This means there are small pockets of information rather than one

interconnected information space (unlike the map of retweets for synthetic biology generally).

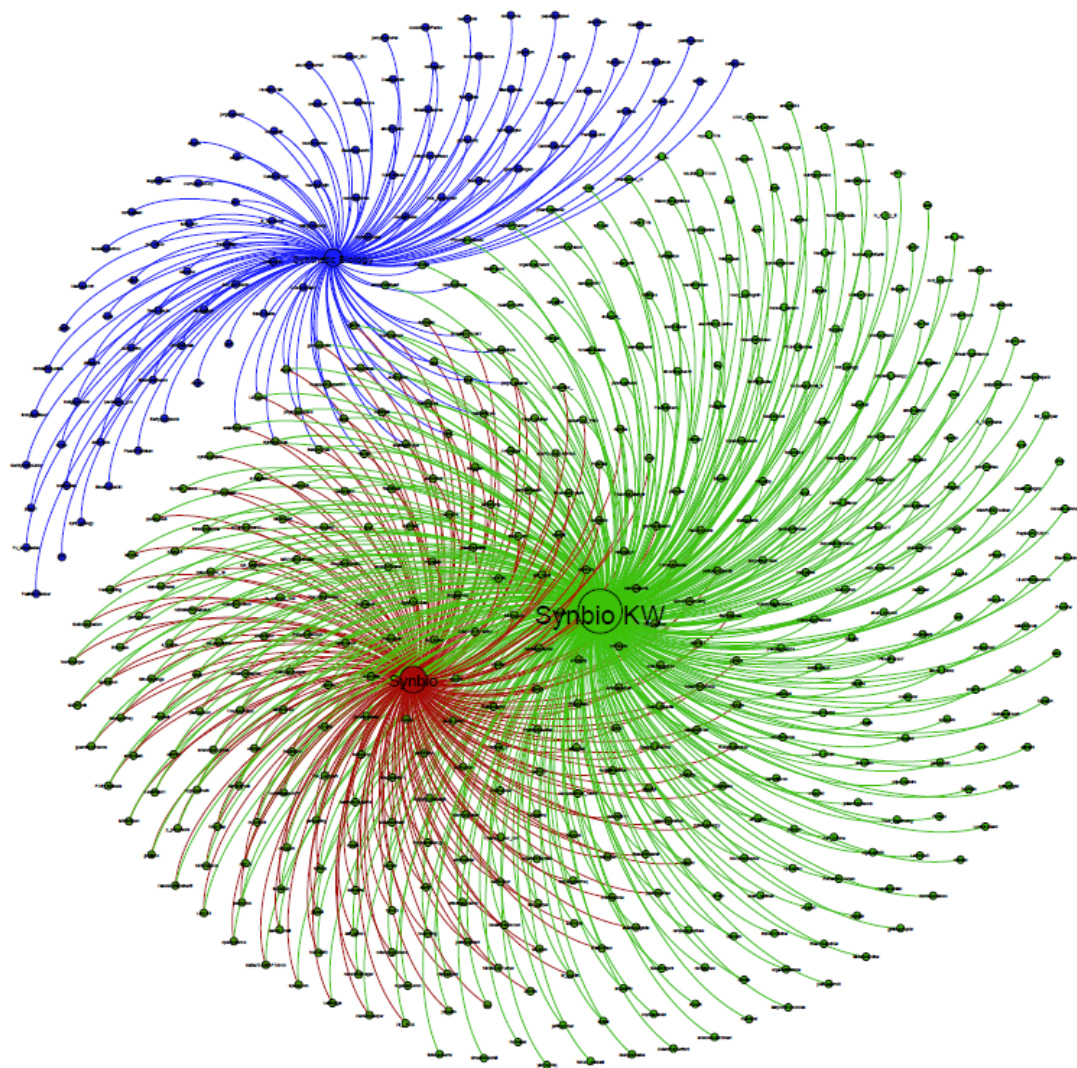


Appendix 4: Twitter data

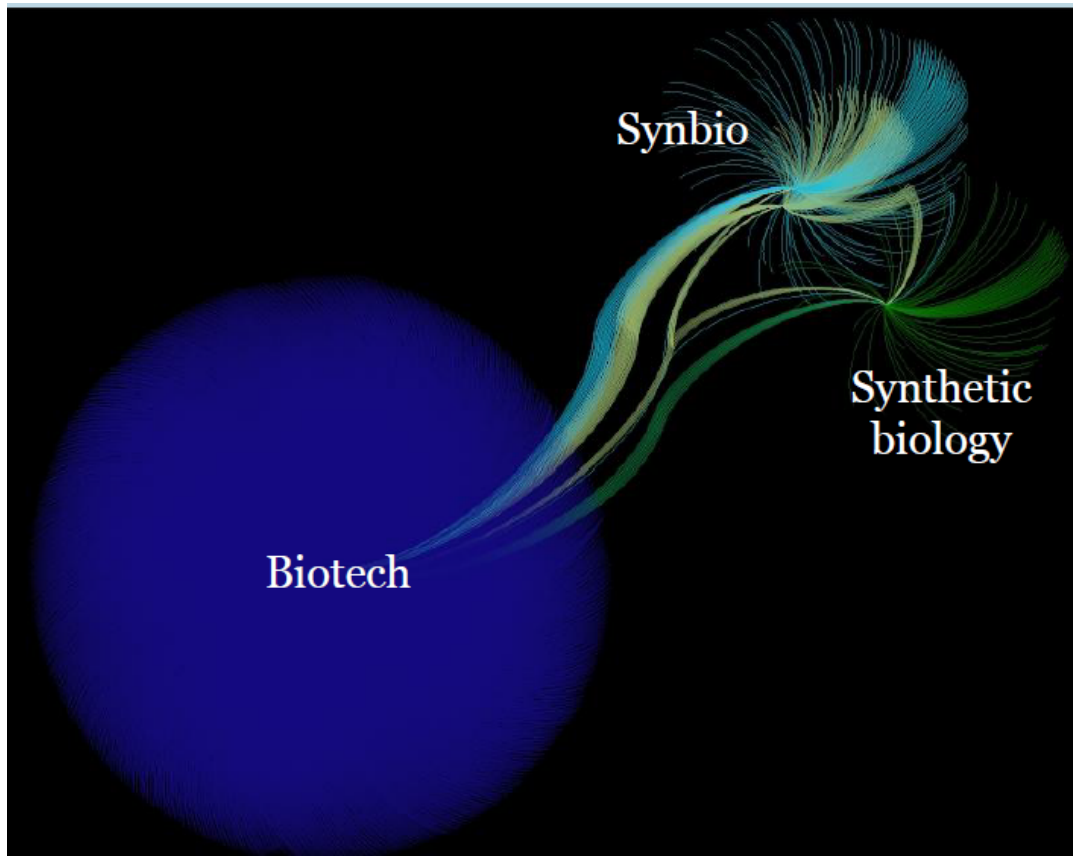
The map below shows the full network of retweets.



This map shows the interconnection between tweets containing the key word (KW)'synbio' and the two hashtags #synbio and #syntheticbiology. Individual users are represented by the dots. It shows that users of the two hashtags are largely having separate conversations about synthetic biology. Disseminating information to users that are tapped into both networks is likely to be most effective as communicating a message widely.

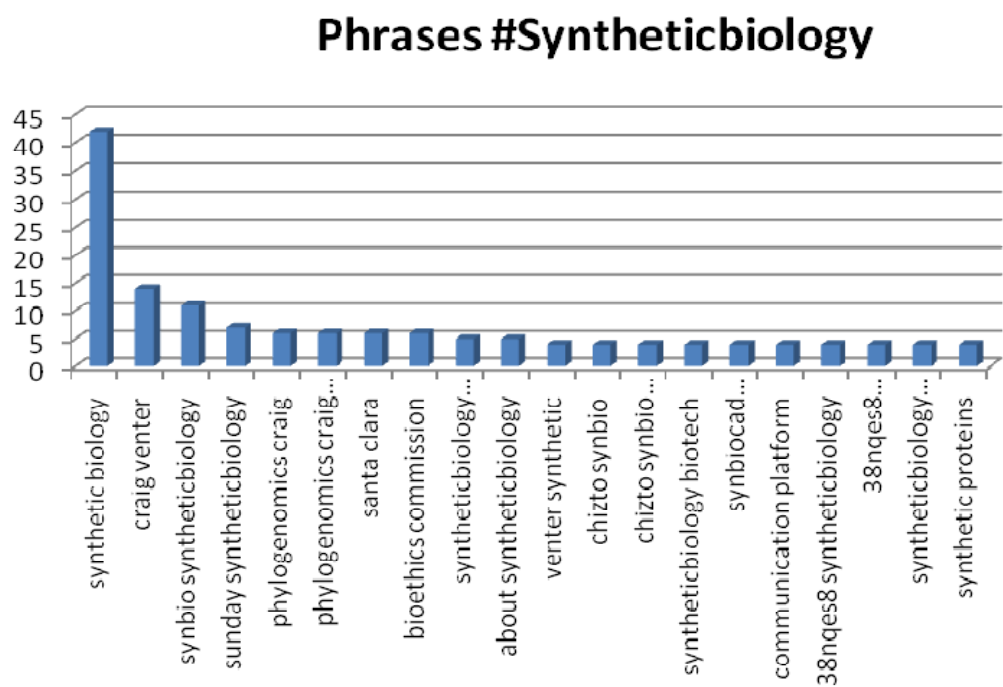
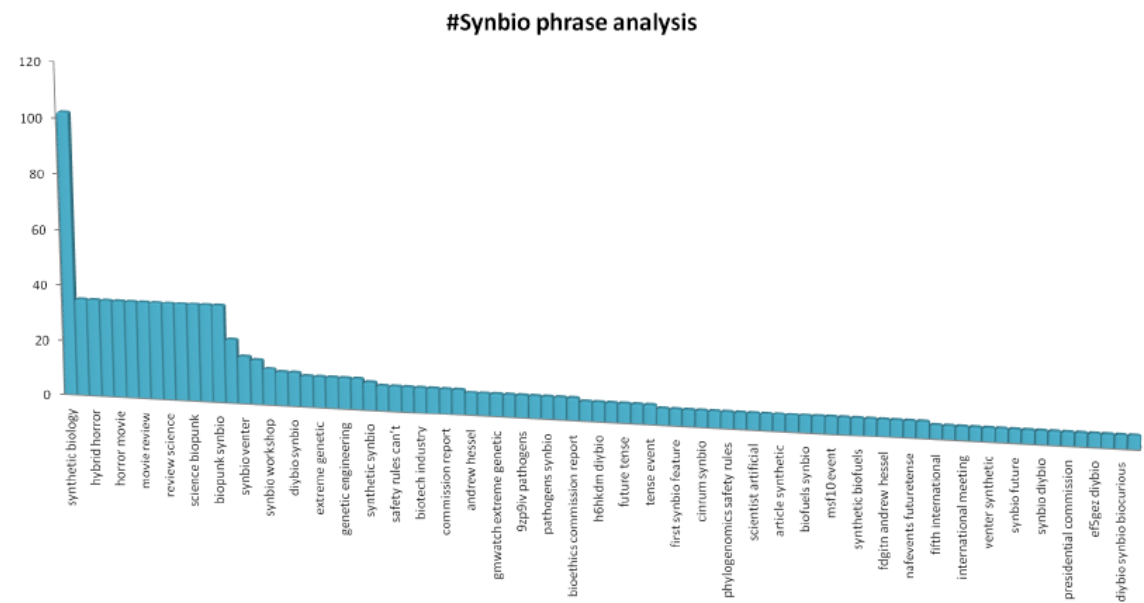


This map shows the two hashtags from the diagram above as part of a larger conversation around the hashtag #biotech.



The topics of conversation are explored in greater detail over the page.

The two charts below show the phrases most commonly used in tweets for the hashtags #synbio and #syntheticbiology.



Appendix 5: Embedding workshop report

The workshop

The embedding workshop was held in February 2011 in Bristol. It was attended by around 40 members of the synthetic biology community. These included scientists, engineers, social scientists, public engagement specialists, designers and artists, as well as representatives from the Research Councils and Sciencewise-ERC.

Broadly, the day was split into three parts. Firstly, participants heard presentations about the dialogue and discussed its messages and implications. Secondly, each of the synthetic biology networks plus the centre at Imperial College, London shared their work on public engagement with synthetic biology via elevator pitches and posters. Finally, there was some structured discussion on how public engagement could be further developed.

The Research Councils took responsibility for reporting actions around the continued public engagement. Laura Grant Associates reported on the discussions about the dialogue, and also reported the findings of an e-survey circulated to participants in the week following the workshop. This report is presented in Appendix 5.

Workshop discussions

What was your main ‘take home’ message from the dialogue report?

It was interesting that different groups and individuals picked up different ‘take home messages’ from the dialogue. Although this was the ice breaker activity, the main themes that emerged went on to be further developed through conversations later in the day.

An important message for the groups related to **public concern over scientists’ motivations**, one of the key findings in the dialogue report.

*Public have nuanced views → some worry about scientists motivations
“blinded by passion”*

Scientists need to ‘bridge the gap’ with the public over motivations

Several groups commented on the idea of **‘naturalness’**: that natural organisms have greater intrinsic value than synthetic ones. Some felt that this was surprising, which could be why it was highlighted by several groups. Related to this, some of the engineers rejected the idea from some members of the public that a **mechanistic view of nature** can be problematic.

*Synthetic vs Artificial. Real ↔ Imitation confusion between these ideas
“Living in a synthetic world made people uneasy”*

Surprised about concept of ‘naturalness’.

A few outcomes I didn’t agree with – e.g. [the public] didn’t like a mechanistic view [of nature], that’s what engineering is!

A number of the groups also felt that the report raised issues about **public engagement** more widely. This was expressed by some feeling more motivated to engage with the media, or by asking when in the scientific process engagement or dialogue is appropriate (and who it should be done by).

At what point in the science process can? should? the public be involved? –

People want to be engaged UPSTREAM

Must talk to the media, and be helped to engaged with the media – For professional units.

How far down into the research do we let them have influence? As a researcher I want my stuff to be judged at the beginning, without public coming in halfway through to question... happy to have them involved, but not sure when?

Another important idea that went on to be discussed later in the workshop was about **tipping points** and how it can be difficult for scientists to see the implications of their work when it is focused on a small specific area. There were differing views on this: some scientists found it problematic, while others felt that they were easily capable of seeing the big picture; that they were members of the public as well as scientists.

‘Incremental’ individual work vs ‘transformative’ effect of field.

Public did not seem to have an issue with creating life – but where is the tipping point eg bacteria ok – monkeys – not?

We are also members of the public and can step back to see the big picture

Several groups also commented on the **generally positive view of science and scientists** from public participants in the dialogue. Some pointed out that scientists are members of the public too.

Scientists were surprised and pleased about positive attitudes, and the interest shown in them + their work

In addition to these themes, the groups identified a number of other messages. These are presented in full at the end of this Appendix.

Do you recognise these as valid messages for researchers?

In response to this question, participants felt **disappointed that the public didn’t think scientists already consider/take responsibility for the social implications of their work**. It was pointed out that ideas about applications were written into funding proposals, which would also offer space for the discussion of implications. Some also felt that researchers in synthetic biology were more likely to consider these ideas than those working in other disciplines. However after some discussion of the disappointment revealed that scientists largely do consider the implications of their work, the challenge of how to articulate this to the public was identified. This

led some to comment on issues around public engagement, which went on to be picked up in responses to later questions.

I take issue with statements like that. It's like we've all been irresponsible and should sit on the naughty chair.

Synbio researchers are perhaps more aware of the societal / ethical / scientific context / issues around their work (than other "simple discipline" researchers)

Insulted that the public don't think scis think about these things – they are people too. → engaging public could show public scis are people?

Overall yes they are valid → but they are being considered → good science is being critical

The discussion went on to expose a **disconnect between the everyday work and the bigger picture**, especially when applications are still far away. This made identifying motivations and implications tricky. Some felt this was problematic, others did not.

But impact comes from all the little bits put together. Motivations of different things in different corners might come together to produce a negative (or positive) result, so [it is] hard to predict

Will we ever know the end point?

Is the disconnect a problem? What's significant about it?

Overwhelmingly, participants felt that researchers have **many different motivations** both known and unknown. Some suggested that these could be articulated while writing grants.

There are multiple motivators.

Compromise between personal interest, professional development, social good, economic benefit.

How has the dialogue changed/will this change...

a) how you think about your research and in what ways?

Researchers felt that the dialogue had made them **think about public perceptions of their work** but that other dialogues and interactions also contributed to this thinking, which is constantly changing anyway. Many were surprised by the lack of understanding of the scientific process among the members of the public that participated in the dialogue and this led to a call from some for better public understanding of how science is done.

Make me think how public perceives science, not changed my direction

We need public understanding of scientists & processes

Informed by multiple 'dialogues' not just one

Researchers felt that they **already thought through the implications of their work as part of funding proposals**. Some cautioned that too much emphasis on implications could lead to **over-selling or hype** which could go against public interest rather than supporting it.

No won't change it because I had to think it through to get funding

Process encourages hype which is dangerous in long run.

b) how do you think about your public engagement and in what ways?

In contrast to impacts on their research, the workshop participants felt that the dialogue was likely to have a much stronger impact on their public engagement work. It was felt that the dialogue had stimulated useful conversations, and researchers were curious about how this would feed back to the Research Councils or Government.

Some felt that the dialogue had prompted them to question their **motivations for public engagement** (as well as for research).

The motivations of research questions are also applicable to public engagement ie. why do we engage the public with synthetic biology?

The Research Councils were seen as a source of guidance in **how to engage, when to engage and how engagement would be funded**. One opinion was that public engagement specialists should be available to support researchers who would otherwise find it difficult to make sufficient time for public engagement.

Needs to be ongoing – longstream not upstream engagement. Not cheap!

Big issue of how to engage with the public is there sufficient money to do this? is there time to do this? do we have the skills?

Needs more properly structured work to engage – with good support

The dialogue has helped me not to underestimate the public → will this change how you do public engagement? → what counts as effective public engagement. → mode remains the same tone is different.

The many forms that public engagement can take were discussed. There was also some conversation about how social media could be used to engage with members of the public about synthetic biology.

So many ways to connect → online → media → lectures, etcetera

How will you demonstrate these considerations in your work in the future?

Discussions around this question were less clear-cut than others. Researchers questioned whether public engagement was a high enough priority for them to deliver the ongoing dialogue that public participants and others aspired to. While they felt engagement was important, **having enough time to do it well** was a significant barrier. Most were already active in one or more forms of public engagement and some were keen to develop their practice.

Can you fit it in? – is it your top priority?

Continue to do engagement activities – not change – need help to do it well/better

The **interdisciplinary** and non-hierarchical nature of synthetic biology was another challenge in terms of public engagement, and raised the question: who takes responsibility? And even if these societal concerns are taken into account where appropriate, researchers were unclear about how they would provide **evidence back to the public** that this had taken place.

Who is responsible in a highly interdisciplinary field? Can't predict when something that needs to be taken responsibility of will emerge. How can we keep an eye on it?

Things aren't always a hierarchy – complex for taking responsibility. Also implications from interdisciplinary aspects. Do PIs look over [this]?

How do you show that you're actually thinking about it? Does it go in a paper? In engagement?

Areas for future engagement

When asked about areas for future engagement, researchers suggested the provision of **clear and precise information about what synthetic biology is**. Importantly, this should include complexity and uncertainties 'without trying to fudge anything'.

It's hard to say where the research is leading. When do you ask about the applications?

A lot of the time it's incremental rather than fundamental. When will the incremental steps come to a tipping point?

In the e-survey, some expressed concern about this focus on knowledge and felt that more should have been done to support discussion about different mechanisms for engagement:

I think everyone wants these programmes to do something important, but as yet they really haven't gone much further than the deficit model's unidirectional flow of expertise that natural scientists struggle to escape from. The event asked us to try and think about novel mechanisms and forms for engagement but gave us little in the way of example, guidance or justification.

They felt that appropriate **incentivisation and support** must be in place for researchers to engage. They also asked for clarity on the role of the **Research Councils** in driving or supporting engagement – this included MRC and NERC as well as BBSRC and EPSRC.

Incentivisation – more means to engage with the public. PE is not valued in the research process. We do not have incentives to do it – funding, recognition would help

We are already thrown into other roles e.g. teaching, but they are structured for us

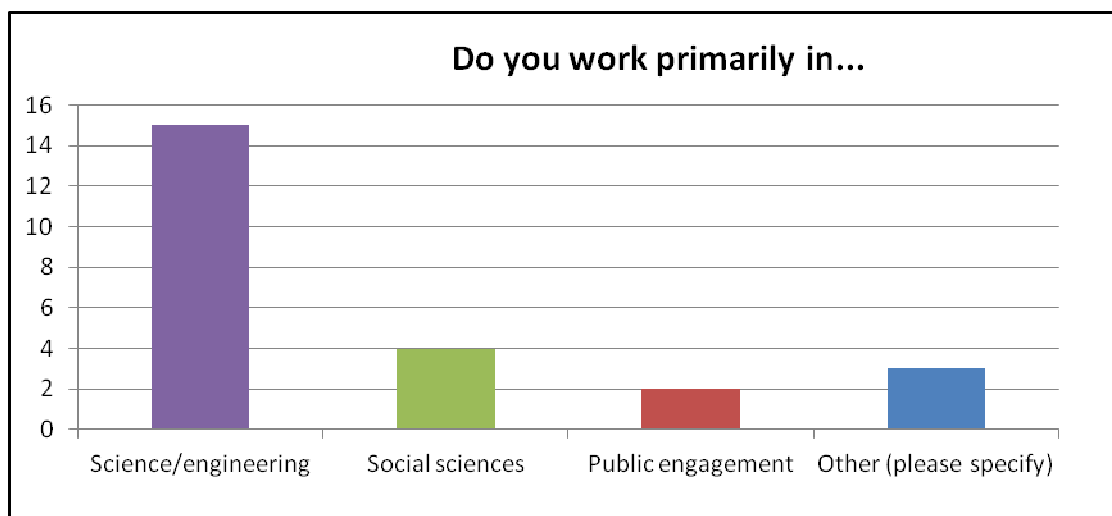
Researchers felt that it was important to engage the **regulators** in discussions, and to consider the implications of the **international** nature of the synthetic biology community.

Good reg. systems in UK – but nothing to compare with?

International difference UK public is exposed to global activity

Post embedding workshop e-survey (n=24, 83% response rate)

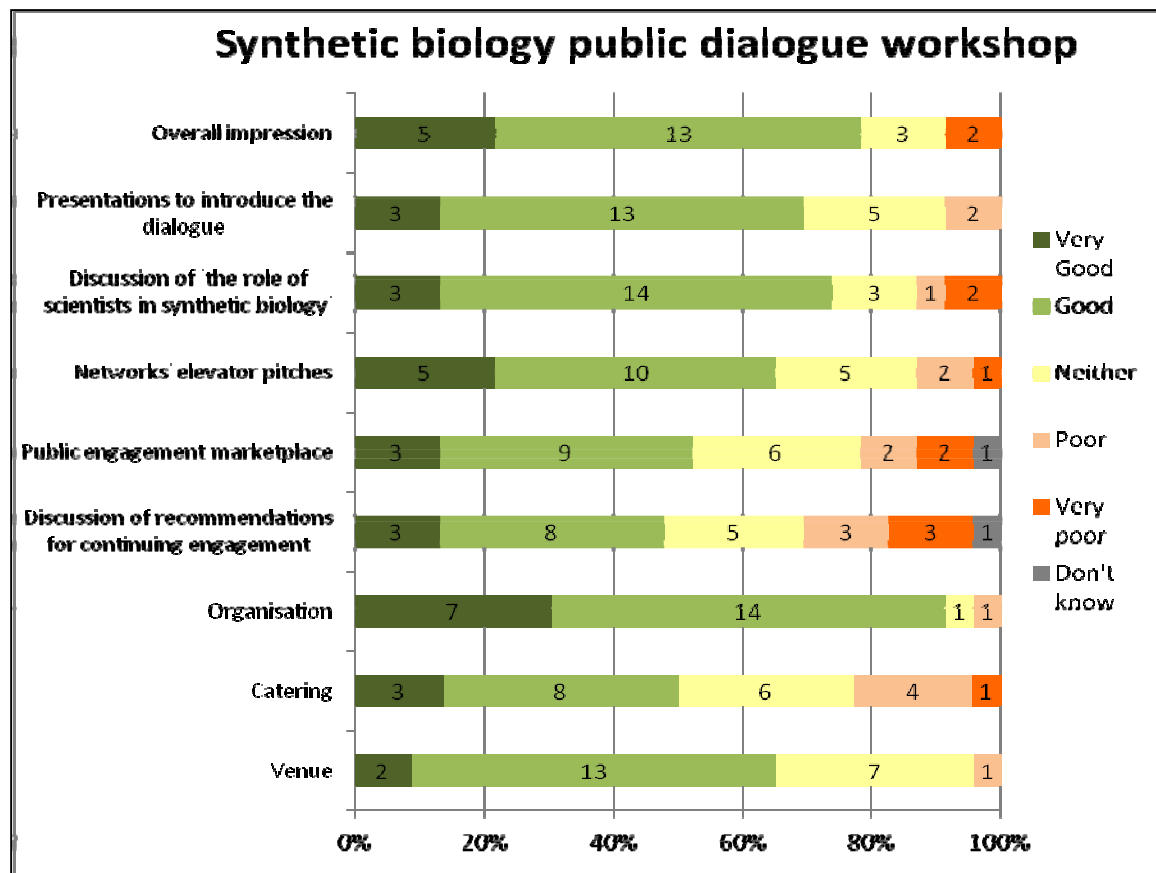
1. Do you work primarily in...



Most attendees were scientists or engineers. 'Other' responses were:

- Environmental NGO
- Design
- Public interest research

2. Please rate the following aspects of the workshop:



Overall, the workshop was well received by the majority of participants. There were two or three participants who responded very negatively to the workshop overall, and a further two or three who gave very mixed responses. However most were positive about the day and felt it was more focused than some of the other network events they had attended.

Participants valued the opportunity to **network and share experiences and ideas** during the workshop.

Overall, an important event to ensure that the dialogue was not a dead-end. A good opportunity for networks to come together and explore the different work being done under the umbrella of 'public engagement' across the UK.

The ideas under discussion on the day were **complex**. Some felt that time constraints meant that discussions **lacked depth or context**, but generally participants acknowledged that a good amount of ground was covered in the time available. Exploring complexities

Discussions of the role of scientists began to be interesting and point up some complexities but there was little time to discuss further.

I think everyone wants these programmes to do something important, but as yet they really haven't gone much further than the deficit model's unidirectional flow of expertise that natural scientists struggle to escape from. The event asked us to try and think about novel mechanisms and forms

for engagement but gave us little in the way of example, guidance or justification.

A number of respondents made suggestions about how the day could have been **organised differently** to make more of the time available.

Posters work well for multiple-day conferences when there are plenty of coffee breaks to browse them. Longer, illustrated elevator pitches would have worked better to give an over-view of activities quickly.

If the questions for the discussion of 'the role of scientists in synthetic biology' session were sent out beforehand then conversation may have warmed up a little faster

Some participants also complained about the lack of food, which was noted and addressed by organisers on the day. In addition, the room temperature was often uncomfortably hot or cold, and some found that the pillars in the room obstructed their view of other participants when they were feeding back ideas.

3. Did the workshop meet your expectations? Why or why not?

Some respondents (6) had few or no expectations for the day. Of the others, twelve responded positively to the question and five negatively. Comments included:

Yes. It is rare to get that mix of scientists, PE people, social scientists and a few interesting others in a room. The discussion was good, and the day well structured. I would have liked firmer outcomes but then am always a bit over optimistic about what can be achieved in a day.

Yes, great to see the different approaches being taken for public engagement. Good that it was addressed that engagement is not the same as dialogue. There should be more meetings of the networks like this, not necessarily in the context of dialogue.

This was the first time that I had been to such an event so I didn't come with any preconceptions.

Disappointing attendance. few senior folks. little by way of evidence shown for the value of public engagement/dialogue - what about exemplars of best practice from outside synbio? a guest speaker??

I really miss the presence of regulators. this has been a big gap all along - why?

4. What, if anything, did you get out of attending?

The strongest theme in response to this question was about **discussions and sharing experience and ideas**, which was valued by fifteen respondents.

Some of the discussions around the table during the session whilst not necessarily focused on the question we were asked were illuminating. In this respect the anecdotal conversation with people from other networks was useful

It was a very useful discussion around public engagement with a group of people who you wouldn't necessarily called evangelists for public engagement. I tend to meet with people with quite polarized views and so it was nice to get an understanding of the views of people who were not.

Five respondents reported gaining a **better understanding of the dialogue and its findings** through the workshop.

The opportunity to go over the results of the dialogue in detail was also useful.

Very interesting to find out what the general public thinks about scientists

Four respondents identified areas where they felt there was **more to be done**.

A need to really drill down into what we mean by terms such as engagement, the 'public' and participation in these discussions.

Being an advocate of social media for science communication I thought that we could do more on that front

Lastly, I think it became clear that there is no more money available to continue the dialogue in this way and that we need to move to other approaches - probably as part of future grants including PE. How the different networks approaches could be coordinated remains an open question that I think deserves a good answer."

I felt inspired to continue the work I've been doing to try and move us forwards in our modes of engagement and dialogue, because clearly we need it!

5. How could the workshop have been improved?

Responses to this question echoed the points raised in question 2. Five respondents would have liked **greater depth and some additional stimulus for the discussions about public engagement**. In our observations, while far from a disaster, these discussions seemed least constructive and this part of the day was rated lowest overall. A number of respondents felt that hearing about some PE good practice from outside the networks would have been beneficial.

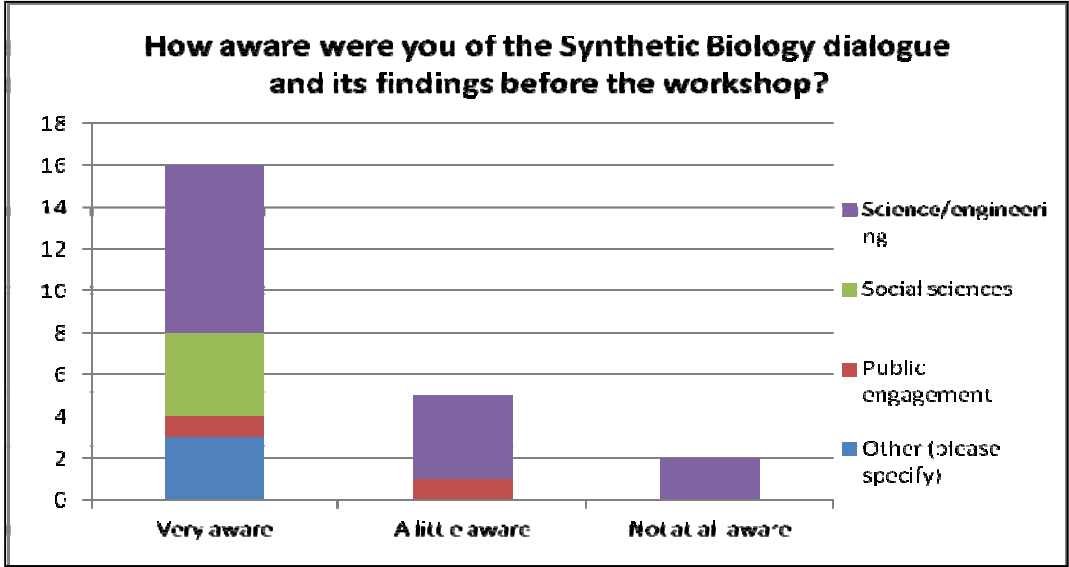
More examples to scientists on how their public outreach could be performed (e.g. debate format) and what it should include

To improve this kind of event, therefore, one needs to test out some modes of engagement that are experimental, and then have more detailed feedback to natural and social scientists about these activities. Presentations shouldn't be like a show and tell exercise, as they were at the meeting, but should be an explanation of how the idea came about, how it was operationalised, how it was performed, what its outcomes were, what lessons were learned, and what the plan is for the next event. This takes more than three minutes and a poster.

A number of participants commented that the workshop **location** was inconvenient, with long travel times, combined with a relatively **early start**. A few would also have liked the opportunity to have **mixed the discussion groups** part-way through the day. One felt the **aim of the day** was unclear.

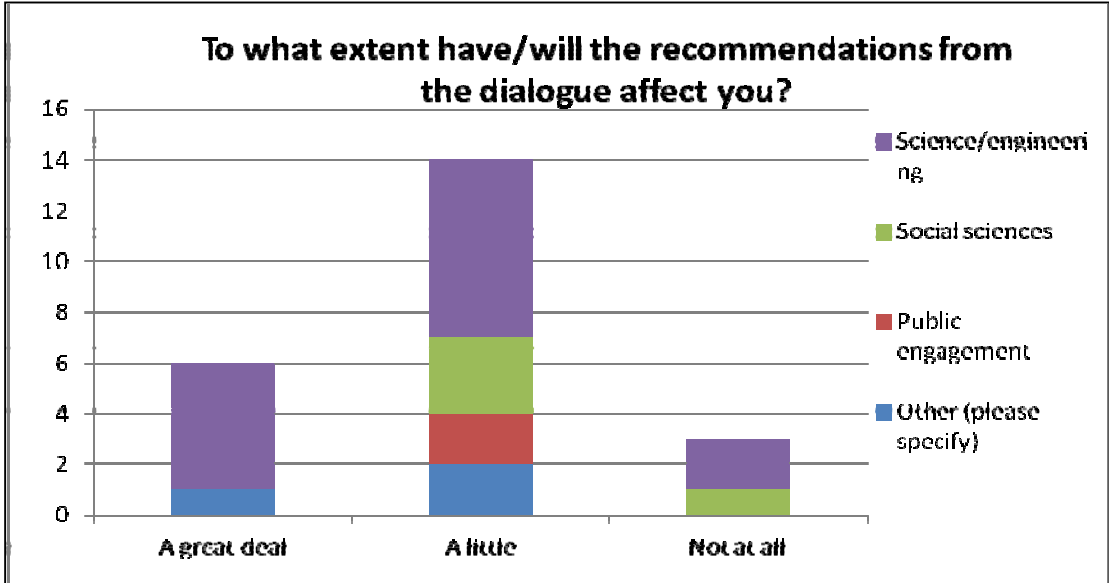
I was not given a clear impression that the workshop had a particular aim of itself. What was it trying to achieve and why do I not know what that was?

6. How aware were you of the Synthetic Biology dialogue and its findings before the workshop?



Six respondents were directly involved in the dialogue as expert participants or on the Steering and/or Oversight Groups. Others had heard about it through colleagues, conferences, by email or through the report launch.

7. To what extent have/will the recommendations from the dialogue affect you?



Responses to this question were mixed, with most respondents saying the recommendations will affect them 'a little'. Interestingly, some respondents gave examples of **how they plan to use** the dialogue or recommendations:

It hopefully will help as we organise / plan further public engagement events

The '5 questions' transcend synth biol - I will use them regularly when training researchers from any disciplines about PE. I will specifically use the dialogue in some training for our network members that we are running in March.

I will attempt to use Web 2.0 technologies to monitor the dialogue and share it my network and the others.

Others felt that their work already encompassed the recommendations.

Some commented on the **public aspirations and concerns** that the dialogue had captured.

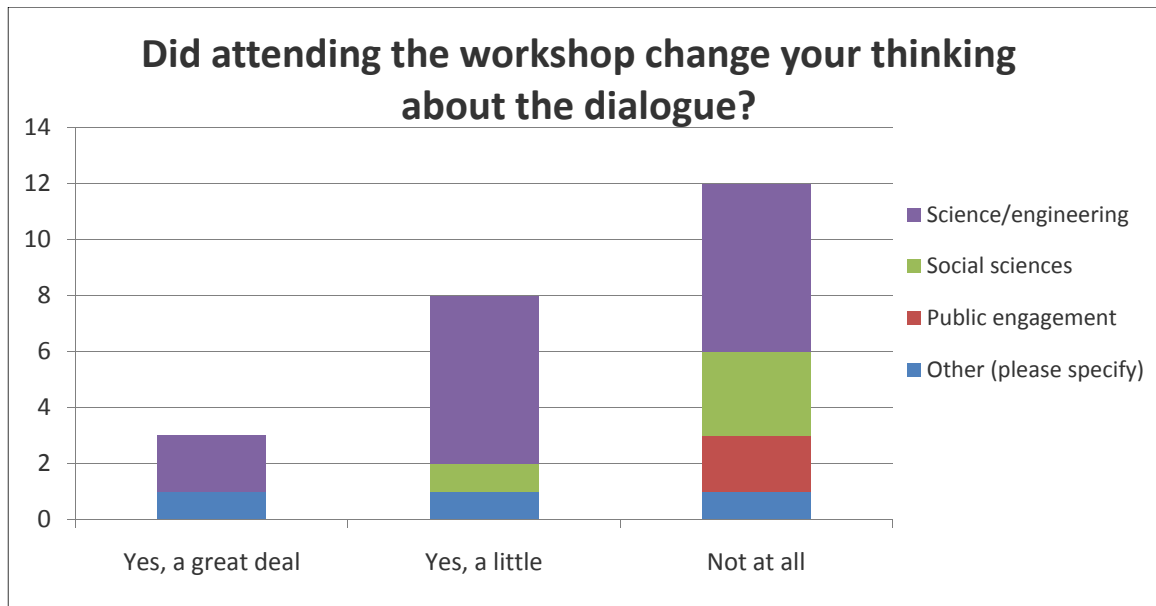
The report was interesting. it contained quite a few statements that I agree with, and quite a few that I disagree with. It therefore helped me question my stance on these issues.

I was surprised to find the public were so approving of the field but it was not news to me that the public have little understanding of what working in research is like. I strongly believe that communicating this better to the public will solve a lot of misconceptions.

For some, discussions had **raised their own concerns** about synthetic biology. This will be discussed in greater depth shortly.

I am still concerned about the mix of disciplines/science cultures. I find scientists rather overconfident about technology still. I worry about their need to sell their ideas to funders versus the reality of what are dealing with here!

8. Did attending the workshop change your thinking about the dialogue?



The workshop had changed ideas about the dialogue for just under half of respondents. Some framed the change in thinking as a clarification, while others framed it in terms of new ideas.

It clarified some points - e.g. who / what is the public?

Yes, it helped better understand the thinking behind the exercise. I still find this a difficult area in the context of synthetic biology, which is a very new science area, particularly with 'higher' organisms such as plants and crops.

Gave me some more ideas for engaging with the public

9. What difference, if any, has the dialogue made to you and/or your work?

Six respondents felt that the dialogue would influence their **public engagement** work, or had influenced their opinion about public engagement.

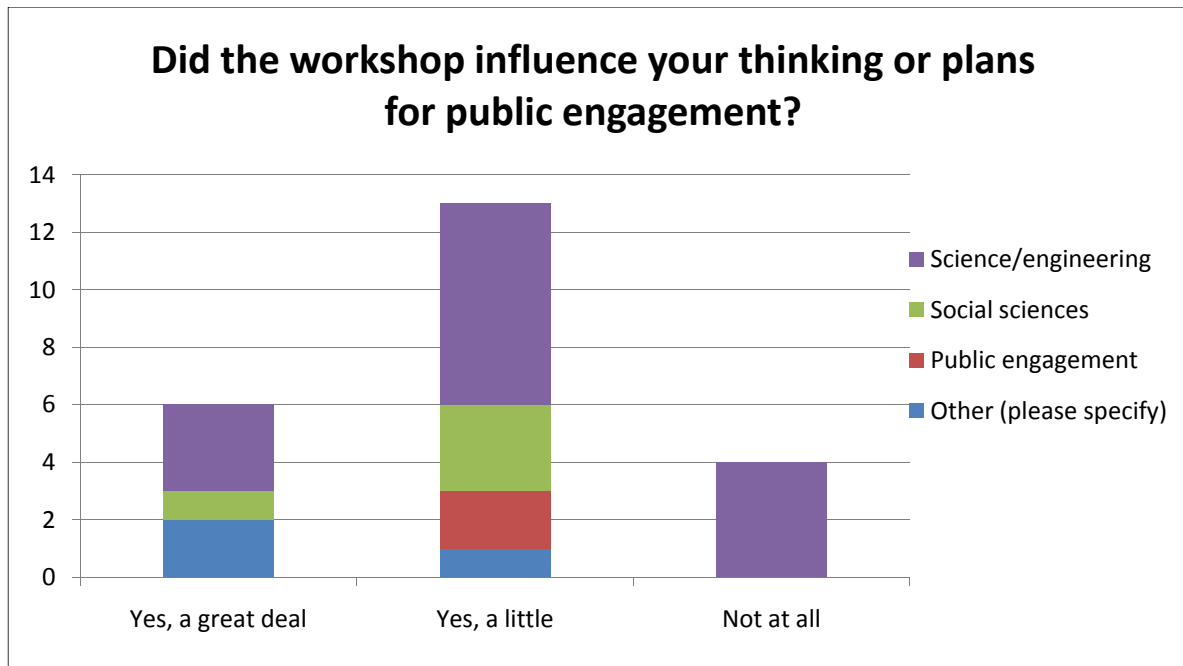
On a scientific basis no - I think I will still be doing the same science - maybe how I publicise that might change. I think that will depend on the results (and if I get the funding to do it)

Participating in dialogue process revealed to me the value of engagement and has encouraged me not to neglect this activity

Three respondents felt that it was **too early for engagement** – reflecting some of the ideas raised in the workshop discussions.

Not much as yet - our work is too early stage to have meaningful dialogue

10. Did the workshop influence your thinking or plans for public engagement?



In contrast to the responses to the previous question, many respondents (10) used the open part of this question to identify hopes and challenges associated with **ongoing public engagement**. Key points raised included who takes responsibility for PE and the exact mechanisms (including online) through which an ongoing dialogue might take place.

I think I'm not in a position to do this. But I find it very important. Somehow I'd like to see a body deployed by the government to do the job. Scientists are probably too busy with the minutiae of research to satisfactorily deal with public communication.

Continuing engagement is a good thing and it is part of what a publically-funded scientist should do

Face to face meetings between scientists and the public, while valuable, are too expensive, inefficient and open to bias. How can we extend the reach of public engagement to wider audiences more cheaply and efficiently?

I think that the engagement of the informed and concerned public is a real gap.

Take a step back, have social scientists and public engagement folk acknowledge their conflict of interest.

I think that we need engagement of the INFORMED public in the debate in order to refine it and have a genuine discussion of the issues. This would help to balance the whole thing better. Social scientists can contribute to this, but we also need ecologists, ethicists, biologists who are not involved in synbio, etc.

Two respondents gave **practical ideas** for moving forwards:

Comments in the dialogue about the incremental nature of research compared with the transformative nature of a field made me stop and think - and I'll use that when training/coaching others.

In documenting the dialogue, is a written report the best way? Perhaps a film or a radio program would work better - capturing people's real voices.

11. In what way/s (if at all) do the Synthetic Biology Networks help or hinder you in engaging the public with the research?

In response to this question, ten workshop participants cited **helpful factors** and one cited a **hindering factor**:

They help but it is really only communication between scientists. We are generally very inexperienced at public engagement (except for a few key individuals in non-natural science disciplines, and even then PE is a byproduct of their work).

They help and this was one of the aims of the networks. For the future we need facilitators who have the knowledge and time to enable the engagement with the public.

Hinder - we run the risk of having the same people having the same discussions with the same cross section of the public and the facilitators and public getting bored.

Others **questioned whether public engagement was included in the remit** of the networks, or felt that the **aims of the engagement should be more clearly articulated**.

I think the networks are a great idea in principle, but I think a strategy needs to be more clearly articulated. Talking to the social scientists that are working in the networks about how to improve the relationship between sociology, science, engagement and responsibility would be a good idea since we're the ones trying to produce this new culture of engagement.

I think the networks do infinitely more than what they could do, given that public engagement was not a direct objective in the call for proposals.

12. What would be most useful to include in the public engagement toolkit?

Participants suggested a number of resources that would be useful additions to the toolkit:

- Case studies and materials to help effectively communicate the science and engineering of synthetic biology;
- Examples of good practice in public engagement and advice on when different methods are appropriate, and with which audiences;
- Access to engagement specialists/facilitators for advice and support;
- A clear statement of the rationale for public engagement and/or creating a 'culture of engagement';

- A platform within the RCs to raise issues about ethics, motivations, clashes of culture and uncertainties;
- Guidance on online engagement approaches;
- Guidance on moving from dialogue findings to ongoing engagement;
- Videos;
- The five questions to help scientists frame their engagement.

Two respondents had not heard of the PE toolkit prior to the survey.

13.If you have any other comments about the workshop, the dialogue or public engagement more generally, please leave them here.

In this space, some respondents expressed **concern about how further PE activity would be resourced and recognised**.

The problem I can foresee is funding. In the absence of professional recognition of the value of public engagement, efforts to continue what the dialogue has started so well are in danger of petering out over time if there isn't financial support for them

I think the funding bodies could have been clearer as to their motives - e.g. to what extent is the outsourcing of outreach to scientists a financial consideration.

A few responses also further explored a theme that had emerged for a vocal minority throughout the e-survey. This related to **mutual mistrust between scientists and social scientists** that was not overt at the workshop. While most participants valued the diversity of expertise at the workshop and in the networks, some felt that scientists were unlikely to act in the public interest or that social scientists had a strong agenda to push public engagement onto the scientific community.

The scientists working on new synthetic biology applications are NOT going to be able to be dispassionate about the risks and benefits. It needs other personnel to talk about these aspects

I find the synthetic biology scientific community particularly challenging to work with, and I thought that was reflected in the day.

Scientists are being completely marginalised by "social scientists" and "public engagement" professionals who are completely dominating all discussion. For those that continually espouse the need for a "dialogue" to be established, they simply refuse to listen to what scientists actually want from this, what they want to do, and how they wish for the interaction with the public to play out. Social scientists are hijacking this process. Mainly out of self interest.

These tensions may be typical of any diverse research community, but we found it particularly interesting that they came through so strongly from a few survey respondents.

Workshop outputs (flipcharts)

What was your main 'take home' message from the dialogue report?

Group 1:

- A sense of shift needed in the research (professional) culture of science – consequences of 'publish or perish' culture - greater transparency, connection of the individual scientist to the field of wider implications of their work (responsibilities).
- Synthetic Organisms have less intrinsic value to natural Organisms – motivation for the human intervention is more important than synth/natural nature of the product.
- Synthetic Vs Artificial. Real \leftrightarrow Imitation confusion between these ideas "Living in a synthetic world made people uneasy"

Group 2:

- Who are the 'public'? Made a real effort to get a wide section of society – v.important
- At what point in the science process can? should? the public be involved? – Interesting they want to think about the role of specific science in society – with the individual scientist – intriguing they want to know about us – what to know about how we do research?

GROUP 3:

- Tipping point: how far [indecipherable] with individuals. – eg ingestion or
- Public did not seem to have an issue with creating life – but where is the tipping point eg bacteria ok – monkeys – not?
- Mechanistic view of life but this is what syn bio is doing
- Should not pretend that it is not mechanistic
- Where should science focus? Which area for commercial products/applications.

GROUP 4:

- Scientists are members of the public
- Worries our industrial involvement – vs. science for the public good
- Scientists need to 'bridge the gap' with the public over motivations
- Public have nuanced views \rightarrow some worry about scientists motivations "blinded by passion"
- People want to be engaged UPSTREAM
- There a lots of 'Take home messages'
- Must talk to the media, and be helped to engaged with the media – For professional units.

- What is the role of the RCs/PhDs/PIs etc? Where does the responsibility lie? – Need ppl & units to do this work – RC or university? – which mustn't be PR
- Results similar to other dialogues
- Scientists are people who work for the greater good – They are citizens too

GROUP 5:

- Science is generally good
- As long as it is of benefit it's Ok.
- Surprised about concept of 'naturalness'.
- Medical (tick) Food (x)
- Acceptance of risk v reward. (but what is reward?)
- Many interests come together in the delivery of regulation
- People want a more open goal funding process
- Scientists were surprised and pleased about positive attitudes, and the interest shown in them + their work
- 'Incremental' individual work vs 'transformative' effect of field.
- Proceed with caution

Key points

1:

- Furthers exposes the disconnect of the everyday
- There are many different motivations; personal, professional
- Disappointed that the public didn't think scientists already considered this – the challenge is to be public about this.

2 a):

- What do the RC's want us to say.
- You have to be careful not to oversell your work and where it will lead.
- Too soon for synbio (in Europe) too soon to do more public engagement.

b):

- The dialogue activity stimulates these conversations. Will it feed back into gov. funding.
- It is a challenge to communicate the science and then have an engagement.
- What we do. What's the value for researchers to do all of this engagement. Its valuable time out of the core research activity. Who pays for it?
- What is Public Engagement, its many different things.

Key points 2:

- At what point do you ask the questions?
- Synbio, how is this different

- Funding mechanisms and the money available will govern this
- Many researchers already did this P.e.
- Lack of awareness of the science world.
- How does this engagement happen? Need to know when to do this; Who? How? What? Framework of best practices.
- Scientists already have a lot of demands on their time. Is this being valued?
- Interdisciplinary – who takes responsibility?
- Express the uncertainty.
- Regulation is key.

QUESTION	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6
<p>Do you recognize these as valid messages for researchers?</p>	<p>Taking a step back to look at role of scis in society more widely</p> <p>Synbio biology + engineering → more curiosity? → more application driven?</p> <p>Insulted that the public don't think scis think about these things – they are people too. → engaging public could show public scis are people?</p>	<p>Yes, but: - How much? - How can you do it all? - Should it be a core activity?</p>	<p>do you always know motivation? driven by research funding?</p> <p>relate xi research with social impacts</p> <p>food product?! When to ask? difficult</p> <p>eg quantum physics 1930's</p> <p>network of effort</p> <p>won't question why you have asked?</p> <p>Research in byte sized chunks → long term engagement to accompany it – evolutionary approach</p> <p>Synbio diff from fundamental sci – what is natural world vs build new things – (indecipherable vs indecipherable)</p> <p>Sum total of many efforts inc (indecipherable) how could it be useful? → product?</p> <p>Forced to indicate and application in application</p> <p>need to show economic benefit (public good) as money gets tighter</p>	<p>There are multiple motivators.</p> <p>Multi intention + multiple seperative problem.</p> <p>Science, knowledge, understanding vs applications.</p> <p>Will we ever know the end point?</p> <p>Where is the recognition for doing engage with public → has to be addressed.</p> <p>Overall yes the are valid → but they are being considered → good science is being critical</p>	<p>Synbio researchers are perhaps more aware of the societal / ethical / scientific context / issues around their work (than other “simple discipline” researchers)</p> <p>Need for independent and int. regulation</p> <p>Context of the outcomes is as important as the message</p>	<p>Is the disconnect a problem? What's significant about it?</p> <p>You engage the public via the big picture of applications</p> <p>Taxes = accountability</p> <p>What's the cope within Grant writing for evidencing motivations and considerations of contexts?</p> <p>How do we evidence what we already do?</p> <p>Compromise between personal interest, professional development, social good, economic benefit.</p> <p><u>How do we know we're right?</u> P-values for visiting Grandmothers (implicitly) → You want to encompass all the risks → Needs to be more than 'what if' 'what if' -> How does the public know it is right?</p>
<p>How has the dialogue changed/will this change</p> <p>a. how you</p>	<p>we consider the under implications of our work at the moment.</p> <p>“Its common sense” Dialogue/Teaching in ethics</p>	<p>? too soon?</p> <p>Impact >> Benefit (RCUK) >> Profit</p> <p>It's not natural to a scientist.</p>	<p>No won't change it because I had to think it through to get funding</p> <p>Any value for research direction?</p> <p>make me think how public perceives science, not changed my direction</p>	<p>Had already though about the questions</p> <p>Can it help but inform (indecipherable)</p> <p>Effect dampened as near end of contract</p>	<p>big issue of how to engage with the public is there sufficient money to do this? is there time to do this? do we have the skills?</p> <p>informed by multiple</p>	<p>No. Work on <u>simple systems (self-assembling peptides)</u> However, as part of the filed 'Yes'. → is there a different weighting depending on this?</p> <p>Basic vs. Applied; Everyday vs. Field. Reifies.</p>

think about your research and in what ways?	Who is responsible?	Danger of over-explanation? Increased positivity → about ourselves?	interact w. schools, artists make me think how public perceives science, not changed my direction surprised at lack of understanding of science process by public we need public understanding of scientists & processes hype vs humility (process) end product Scientist relation w. public – surprised by (indecipherable) public opinion of scientists	In the pub conversations with friends! Should do on larger scale → be transparent + clear May make me fill out impact assessment/statement more effectively → culture of overselling science – CARE → danger if don't will use out on grant. process encourages hype which is dangerous in long run.	'dialogues' not just one changing constantly - (intelligible) changes unlikely to change orientation to particular applications – it is the funding process that drives this / ie RC strategic directions	It just seems like there is a disconnect.
b. how do you think about your public engagement and in what ways?	Do more >> it's positive Understand what it is & What is it? Who are the public? Impact statements? → <u>REF/Grants</u>		highlighted need to have intercommunication public/scientists are public just (indecipherable) consumers of tech? needs more properly structured work to engage – with good support Specialist public engagement people to devise structure + scientist (indecipherable) report <u>will</u> change it infrastructure for engagement	until clear where discovery is going need to engage more specifically → but nonetheless need to be clear, v.open Timing issues → when to engage next. Good embedding social scientists Tipping points/meaningful.	In contrast to effect on research, the dialogue has impacted on how we engage with the public around synthetic biology The motivations of research questions are also applicable to public engagement ie. why do we engage the public with synthetic biology? Acknowledging mistakes So many ways to connect → online → media → lectures, etcetera The dialogue has helped me not to underestimate the	More creative, twitter, cartoons, social media – ie bottom up processed – not focus groups. (vivid approaches) Who pays for this? Value for us? R.E.F. / credit. Need to reconsider public information / (education) scientist -> public

					public → will this change how you do public engagement? → what counts as effective public engagement. → mode remains the same tone is different.	
How will you demonstrate these considerations in your work in the future?	<p>full cross-disciplinarity participation → RCUK help → expertise → funding?</p> <p>Can you fit it in? – is it your top priority?</p> <p>Thought of for the beginning.</p>		<p>incorporate?</p> <p>(show public you think about those things?)</p> <p>continue to do engagement activities – not change – need help to do it well/better</p> <p><u>when</u> do I do engagement?</p> <p>should Research Councils take that on? pool expertise</p> <p><u>facilitate</u> process</p> <p>different roles (of scientists) – levels – bench scientist/engaging</p> <p>“scientists should take resp” – hardly time to do work</p> <p>hierarchies of responsibility versus complex systems (intradisciplinary)</p> <p>complex sci processes – incremental – when tipping point?</p>		<p>How do you show that you’re actually thinking about it?</p> <p>Does it go in a paper?</p> <p>In engagement?</p> <p>Um.</p>	<p>Involve social scientists in our grant</p> <p>Qualify – <u>where</u> appropriate <u>when</u> <u>how</u> – will vary</p> <p>Training for new scientists Phd’s etc. → but need specific and timely training rather than generics</p> <p>More use of social media – as universities – as individuals</p> <p>Official approval at beginning of grant – how to get societal engagement?</p>
Other comments	<p>MRC? – where? translational...?</p> <p>ESRC?</p> <p>NEKC too</p>		<p>Interdisciplinary issues? How address?</p> <p>Systems biology, informatics, (indcipherable) vs who takes responsibility? when? ‘emergent properties’ of synbio</p>	<p><u>Areas for future engagt</u></p> <p>Open access to info on the sBio</p> <p><u>Incentivisation → MUST</u> address valuing public engagt – more than tick</p>	<p>Which public do you want to engage with?</p> <p>International difference UK public is exposed to global activity</p>	

			<p>Principal investigators to keep oversight</p> <p>hard to predict social systems – how they will move</p> <p>(indecipherable) you can't anticipate</p> <p>good reg. systems in UK – but nothing to compare with?</p> <p>nanoparticles – impossible for regulators</p> <p>uncertainty – excitement vs certainty ambivalence/uncertainty</p>	<p>box! (realise next job/grant important!)</p> <p>Need people in depts to do the public engagt.</p> <p>open days</p> <p>mass/more accessible media on syn bio</p> <p>more info on what it is to be a scientist/ motivations.</p>		
--	--	--	--	---	--	--