Report to the Royal Society

Evaluation of Genetic Technologies Public Dialogue and Opinion Survey

6th March 2018

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Contents

Acronyms

BAME	Black, Asian and Minority Ethnic
BBSRC	Biotechnology and Biological Sciences Research Council
BEIS	Department of Business, Energy and Industrial Strategy
BRCA	Tumour suppressor genes, harmful mutations of which may produce a hereditary breast-ovarian cancer syndrome in affected persons
CBD	Convention on Biological Diversity
CG	Contact Group
CRISPR/Cas9	Family of DNA sequences in bacteria which have been developed as a technique for editing DNA
DNA	Deoxyribonucleic acid
EU	European Union
Genome	The complete set of an organism's (unique) DNA
Genome editing	Process of adding, removing or replacing DNA at a precise location in the genome
Genetic Modification	Modification of a gene or to insert genes into the DNA of another organism at random
GM(O)	Genetically Modified (Organism)
Genome sequencing	Process of working out the complete DNA sequence of an organism, which enables understanding of what genes that organism has.
Heritable genetic disorder	A genetic disorder that can be passed down from parent to offspring
HFEA	Human Fertilisation and Embryology Authority
HTA	Human Tissue Authority
HVM	Hopkins Van Mils
JIC	John Innes Centre
NGO	Non-Governmental Organisation
ONS	Office of National Statistics
SLCU	Sainsbury's Laboratory Cambridge University
TOR	Terms of Reference
USDA	United States Department of Agriculture

1. Introduction

This evaluation report has been prepared by URSUS Consulting Ltd on behalf of the Royal Society in relation to a project to engage in a public dialogue and opinion survey to improve understanding of public attitudes towards genetic technologies in plants, animals and humans.

The process, run by Hopkins Van Mil (HVM), involved citizens from three UK cities (London, Norwich and Edinburgh) in dialogue workshops followed by a nationally representative survey of 2061 individuals. The project started in July 2017. The final report will be published in March 2018 and will be disseminated through a series of communications and public events led by the Royal Society.

1.1 Background

Genetic technologies - anything to do with understanding, making or adapting genetic material - have a long history and the very fast pace of recent scientific developments have made understanding and adapting genetic material faster, easier and cheaper. Using genetic technologies such as CRISPR/Cas9 mean that some previously theoretical applications are becoming increasingly practicable. However, public attitudes to genetic technologies – largely informed by tensions around Genetically Modified (GM) plants grown for food – in the UK and Europe have been characterised by high levels of concern about the risks they might pose. Sensational coverage of potential uses of genetic technologies in human, animal and plant domains have tended to increase the public's concerns around development of transgenic animals, biosecurity fears and the ethics of tinkering with the design of human beings. Negative public opinion may also have been reinforced by the precautionary approach to genetic technology regulation which has been taken by the EU. Poised to leave the EU, the UK will face new choices about its regulatory framework for genetic technologies.

In the past the UK government and scientific community's response to negative public opinion to genetic technologies has been based on a 'deficit' model of public engagement, which attributes public scepticism or hostility to a lack of understanding and assumes that if participants understood more of the underlying science and the opportunities it offers, then negative public opinions could be 'corrected'. In recent years the Royal Society and the research community have engaged in a more 'deliberative' model which involves informing, listening to, and working closely with the public to provide opportunities for everyone to engage with science so that the public can participate in helping decide what research should be developed and commercialised, why, and under what conditions. The Royal Society has commissioned this public dialogue and opinion survey to explore the range of views that individuals hold concerning potential applications for genetic technologies.

The dialogues and survey are one strand of the Royal Society's programme on genetic technologies launched in 2017 which also involves working closely with the Chinese Academy of Sciences on priorities for genetic technologies research and how the research and use of these technologies should be governed. The overall objectives of the programme are:

- To inform the policy environment for the application of genetic technologies to plants and animals;
- To inform and catalyse early debate around future uses of genetic technologies in humans; and
- To help ensure that genetic science, which is developing rapidly, is done safely, in ways and for purposes which the public feel comfortable with.

To achieve these objectives, the programme aims to:

- Engage in a public dialogue to improve understanding of public attitudes;
- Work with industry and international partners to explore a sub-set of current and near-future (0 – 10 years from the present) applications and identify implications for policy and society;

- Work with others, to support wider communication of the findings from their public dialogue, international and industry work to interested publics;
- Identify and analyse issues that need to be addressed to ensure the societal benefits of the technologies are maximised and risks minimised, with a focus on the UK; and
- Make evidence-based recommendations for policymakers, industry and the research community in the UK and internationally.

1.2 Objectives of the public dialogues and survey

The public dialogues and opinion survey are intended to help inform the Royal Society, its fellows and their organisations, and those represented on the Contact Group to identify areas where the public does or doesn't think that further research and development offers opportunities or threats. This will provide a basis for advising policymakers on any implications for how genetic technologies should be regulated and how the public should be engaged with in the future.

The objectives of both the qualitative and quantitative research are to:

- Explore commonalities and differences in attitudes depending on applications;
- Identify the problems that people feel genetic technologies are well placed to solve as well as the areas where they would prefer greater emphasis be put on other solutions;
- Identify the frames and contexts that moderate the public acceptability of developing UK research into genetic technologies; and
- Identify who is trusted to work on particular technologies or applications, why, and with what implications.

Both parts of the research have focused on:

- The application of genetic technologies to plants and microorganisms, including as sources of food, medical compounds or raw materials;
- The application of genetic technologies to animals, including animals as pests, sources of food, companions and wild creatures; and
- Near to medium-term future (0 – 10 years from the present) scenarios for the application of genetic technologies to humans, including heritable and non-heritable interventions for both the treatment and prevention of disease and disability and the enhancement of traits and abilities.

The findings from the dialogues and surveys were intended to feed into the wider programme being presented at a meeting with the Chinese Academy of Sciences in March 2018 and to an industry group meeting in March 2018.

2. Methodology for Dialogues and Opinion Survey

2.1 Governance

Contact Group and project management

In order to oversee its Genetic Technologies programme the Royal Society established the Genetic Technologies Contact Group (the Contact Group), with 18 members and chaired by Robin Lovell-Badge of the Francis Crick Institute. The aim was to convene an expert group with researchers across all the relevant research domains (humans, plants and animals) and with a policy perspective, as well as experts in ethical, regulatory and security issues. Initially the group was recruited for three meetings between July 2017 and March 2018.

The Contact Group is tasked with overseeing the public dialogues and opinion survey. Their brief included: helping frame the public dialogues and opinion survey; commenting on materials produced by the Royal Society and the contractors (HVM); reviewing the final report; and deciding how findings and outputs should be used. On the advice of Contact Group members the Royal Society secured additional funding from BBSRC for the independent evaluation.

The relationship between the Contact Group and contractors was mediated by the Chair and a three-person Royal Society core project team. During the scoping stage the contractors interviewed eight Contact Group members to get their suggestions on resources, genetic technologies opportunities and risks, and their personal expectations for the public engagement process. Their comments on materials shared with them were used to amend the dialogue materials and survey design. A full list of Contact Group members and the core Royal Society team is shown in Annex A.

2.2 Framing of the dialogue

The brief was open in suggesting the balance between qualitative and quantitative elements of the research, the numbers involved in each and the locations for dialogue workshops. The contractors suggested a combination of up to 90 dialogue participants in three one day and three half day meetings in different locations to give a good geographic spread and include urban and more rural populations. The dialogues were undertaken between September and October with a rapid analysis of findings so that the results could be validated by an online nationally representative survey of 2061 adults during early November.

The overall framing of the dialogues and survey to cover the very broad range of research applications of interest was a challenge. Since the public engagement elements emerged from the Royal Society's genetic technologies programme, the Contact Group agreed that the starting point needed to be the opportunities for applying genetic technologies over the key research domains (plants, animals and humans). Despite lively debate about whether genetic technology should even be mentioned in the dialogues, on balance it was agreed that to downplay genetic technologies would be to risk accusations of a lack of transparency from wider stakeholders. The framing has tried to strike a balance between a 'process' driven approach (focused on genetic technologies themselves) and a 'product' driven approach (focused on the results of using a genetic technique to address a specific health, food system or environmental problem). Both approaches were placed within the context of global problems that the technologies could help to solve.

Given the scope and complexity of genetic applications spanning the three research domains the Contact Group agreed that it would be most appropriate to give the participants in all three locations the same general overview of genetic technologies but then for each group to focus in on one area: animals; plants; or humans. The locations for the discussions were strongly influenced by

where existing centres of excellence could be drawn on to provide scientists and bioethicists as specialist panellists. The chosen locations and genetic technology focus for each were:

- Edinburgh: animals with expertise provided by the Roslin Institute and the University of Edinburgh;
- Norwich: plants with expertise from the John Innes Centre (JIC) and the University of Cambridge; and
- London: humans with expertise from the Francis Crick Institute.

In framing the research the Royal Society and the Contact Group members were keen to avoid a science knowledge deficit model. Specialists were on hand to answer questions around the chosen technologies and applications but the main purpose of the dialogues was to understand and learn from the public based on their own experiences and deliberations around societal issues. The opinion survey was then designed to test how far the views expressed in the dialogues were shared by the public at large. The quantitative survey also attempted to set opinions within an understanding of their general interest and understanding of science and genetic technologies. The survey was designed to allow comparisons between similar ranges of genome editing and genetic modification – from minor modifications to adding genes from other species - for each of the three research areas. In order to be able to make such comparisons the online survey covered a wider range of applications/traits than were discussed in the dialogue discussions.

Previous experience with public dialogues and surveys in this area (e.g. Sciencewise supported work on mitochondrial heart disease and surveys by the Francis Crick Institute) suggested that religious affiliations and age/life stage might be strongly associated with an individual's overall response to human genome editing and so the survey was framed to allow a disaggregation and cross-analysis of responses by these characteristics.

2.3 Detailed Tasks

Recruitment of participants

90 participants were recruited for the three locations with the aim of 25-28 attending at each location. The recruitment brief was for a broadly representative mix of the population in each location in terms of age, gender, life stage, social grade/household income, geography and ethnicity. Participants were asked to carry out a short pre-task before participating. Informed consent consistent with the DPA 1998 was sought on recruitment and participants also signed permissions for filming vox pops which could be used on the contractor's and the Royal Society's websites. No consents were sought for the Royal Society to maintain contact with participants after the dialogues were completed.

Participants were recruited for an evening dialogue workshop (5:45 to 9:15pm) and a full day three weeks later (9:45am to 4pm). Recruitment was on-street or by telephone with a specific requirement not to use snowballing techniques, recruit friendship pairs or individuals who had taken part in a focus group or public dialogue in the previous six months. In each location at least three participants (10% of the total sample) were recruited as interested in genetic technologies (scoring 4+ on a five point scale where 1 is not at all and 5 very interested). All participants were given a staged cash incentive of £160 to attend the dialogue. The incentive was phased so that a higher amount (£100) was given after the second round workshop, to help reduce attrition between the dialogue workshops.

There were 82 participants for Round 1 workshops and 70 for Round 2. Evaluation results are based on 81 completed questionnaires for Round 1 and 68 for Round 2.

Development of stimulus materials

Across the three locations the design of Round 1 and 2 were very similar, with identical structure and format of materials, but with different case studies and PowerPoint presentations to reflect opportunities and issues associated with the specific focus on animals, plants or humans respectively. The design included a mix of plenary and small table sessions and techniques for sharing information, including an animated film, PowerPoint, Talking Heads videos, timeline wallchart, case study handouts, a jargon buster and Q+A sessions with expert panellists (specialists), and for encouraging discussion (brainstorming, working in pairs, role play, carousels and preparing their own posters).

The first evening covered:

- Introductions, objectives of the dialogue and housekeeping;
- An initial warm up activity (people had been asked to bring clippings from media or online research on genetic technologies in the news);
- A Royal Society presentation on the history of genetic technologies including a short animated film made with Wellcome Trust and a Talking Heads video on the purpose of the dialogues;
- Discussions of one case study in each location (farmed salmon, human embryo genome editing or growing human vaccines in tobacco plants) with each table identifying two key questions to be asked to the panel of specialists in plenary; and
- Feedback from specialists on what they had heard and how it would inform Day 2 followed by briefing on a short homework task and completion of a feedback evaluation form.

The full day covered:

- Introductions, objectives for session 2 and housekeeping;
- Small table feedback on the homework task of discussing issues arising in Round 1 with at least two individuals (family, friends or colleagues);
- Plenary presentation of a second Talking Heads video representing wider stakeholder views including Skype interviews with Patrick Holden (ex- Soil Association), Sarah Chan (the bioethicist who was also a specialists in the room for some events) and a YouTube insert from Greenpeace International Director, Kumi Naidoo;
- A PowerPoint presentation by the Royal Society on the history of genetic technology research and development in the specific areas, including the regulatory regime;
- Table discussions of one of three case studies (see Table 2.1) followed by a plenary Q+A session with the panel of specialist speakers;
- Role play – "Put yourself in their shoes" – identifying the key issues faced by different stakeholders in the debate (government bodies, regulators, university researchers, business funded researchers, businesses, charities/foundations and professional/specialist networks), leading into a session to make posters presenting each small group's overall attitude towards future development of genetic technologies in their case study area;
- A 'Roving ideas storm' or carousel with groups moving between four work stations for quick fire views on what they would or would not find acceptable in terms of individual or societal welfare, environmental impact and cost considerations in relation to GT development;
- Small group sessions with each individual ranking who they would trust most/least to develop and deliver, and then to advise and inform, and finally to regulate the use of GTs; and
- A final plenary session with each group presenting the key issues they had taken from the final discussions and the specialist panel feeding back on what they had learnt and how they would use it in their work and final feedback questionnaire.

Table 2.1: Summary of case studies

	Plant	Human	Animal
Understanding genomes		• Genome sequencing	
Food system challenges	• Potato blight		• Farmed salmon
Human Health	• Human vaccines grown in tobacco • Golden rice	• Leukaemia • Editing embryo DNA	• Pig organs for human transplant • Genetically modified mosquitos

Public Opinion Survey

A public opinion survey aimed at 2000 nationally representative responses to validate the dialogue findings. The survey used Toluna, an online platform which draws on its own panel of thousands of individuals from across the UK, and ran between 1 and 13 November. The Survey was expected to take 15-20 minutes and include up to 50 questions. Respondents who met the demographic target requirements received rewards in the form of redeemable points and vouchers from Toluna.

The survey tested how widely held the views on each of the three dialogue areas were and allowed cross-comparisons across themes about which types of technologies and applications were more or less acceptable, who the public trusts to work on, provide information on and regulate genetic technologies.

Analysis and reporting

Discussions at the public events were recorded as a back up to facilitator notes. Vox pops with 18 willing participants were recorded during Round 2. A PowerPoint presentation of the findings – an account and initial analysis of what was said at the six events and in the public opinion survey, and pulling out shared themes – was presented at the second Contact Group meeting and in a draft final report circulated to the core management team in December. The final report will be one output of the Royal Society's Genetic Technology programme. An infographic will also be developed based on the study materials.

3. The evaluation methodology

3.1 Aims

The evaluation ran from mid-September 2017 to January 2018. The aim was to provide an independent assessment of the public dialogues' credibility and its effectiveness against its objectives, including an early assessment of its impacts. It seeks to answer the following questions:

- Objectives: has the dialogue met its objectives? (Section 4)
- Good practice: has dialogue and survey design and delivery met good practice? (Section 5)
- Satisfaction: were those involved with the dialogue and survey process satisfied? (Section 6)
- Governance: how successful has the governance of the project been? (Section 7)
- Impact: what difference has the dialogue made or might it make in the future? (Section 8)
- Costs/Benefits: what was the balance overall of costs and benefits of the dialogue? (Section 9)
- Credibility: was the dialogue process seen as credible and the findings suitably robust for the research community and policymakers to use the results with confidence? (Section 10)
- Lessons: what worked well and less well, and more widely and what are the implications for the Royal Society's future work)? (Section 11).

3.2 Methodology

Document review

Formative evaluation comments were submitted to the core team by email or in person covering:
Key written correspondence (email traffic and attachments) and working documents on process and survey design. The choice of number and location of events, the recruitment sample, brief and methods and the framing had all been agreed before the evaluation was commissioned;
Stimulus materials for the public dialogues and several rounds of the online opinion poll; and
Review of project outputs including draft and near final reports and survey results.

Observation and meetings

The evaluators directly observed all six public dialogue events (Rounds 1 and 2 in Norwich, London and Edinburgh) and took part in regular face to face and teleconference meetings with the core team and contractors in London. We provided feedback after each dialogue event.

Questionnaires and evaluation exercises

At the end of both Round 1 and 2 events all participants (public and specialists) were asked to complete an evaluation feedback form. The results of both sets of questionnaires are summarised in Annex B and quotes from the feedback are included in this report in italics.

Individual Interviews

Individual interviews were carried out at key points through the study including:

- Informal discussions with the Royal Society, the specialists and the observers attending the dialogue;
- Informal discussions with half the public dialogue participants over the course of the two days;
- Semi-structured interviews with 11 individuals from the core management team, contractors and Contact Group after the initial findings had been presented to the Contact Group and the draft final report shared with the core management team. Quotes from these interviews are attributed in the text to 'specialists'.

Reporting

Immediate reflections were discussed with the core management team after each of the public events. Initial analysis of the participants' responses to the events was circulated electronically to the team after the Round 1 and Round 2 events were completed

4. Objectives

4.1 Introduction

Table 4.1 summarises how different elements of the research were expected to contribute to achieving the four overarching objectives of understanding public opinion about genetic technology applications, technologies, context/caveats and who is trusted to develop, inform about and regulate. The objectives were similar across the two research strands with each of the dialogues looking for a depth of understanding of the public's views for one research domain, while the survey looked to provide a statistically relevant snapshot of how widely these views are held. The survey covered all three research domains.

Table 4.1: Project objectives and contribution by different components

Overall project objectives	Dialogues (each focusing on either human, animal or plants)	The survey (covering all three domains)
Applications	Exploring commonalities and differences in attitudes depending on applications, source of the change introduced and contexts.	Clarity on the applications that a majority of the public do or do not support, why and under what conditions.
Technologies	Assessing the role of genetic technologies in solving global challenges as well as those where they would prefer greater emphasis be put on other solutions.	Clarity on the processes that enjoy public support.
Context and caveats	Identifying the frames and contexts that moderate the public acceptability of developing UK research into genetic technologies, e.g. UK competitive advantage, individual welfare improvement, collective welfare improvement, and environmental improvement.	Clarity on any benefits, e.g. cost, safety, efficacy, what the public feel should be considered alongside the risks.
Trust in different actors	Identifying who is trusted to work on particular technologies or applications, why, and with what implications, e.g. public vs. private researchers, for profit vs. not for profit commercial organisations.	Clarity on which actors are trusted to work on which applications.

4.1 Participants

The project's objectives were presented by the Royal Society in the Round 1 discussions, were highlighted by specialists who contributed to the Talking Heads video and revisited again during the introduction to the second day. The closing session of Round 1 (in Edinburgh and London after a tweak following the Norwich pilot) was designed so that both Royal Society representatives and specialist panellists could summarise how they planned to use what they had learnt from taking part and to inform the design of Round 2. This was repeated on Day 2 to share what specialists and the Royal Society had learnt and how it would inform their own work and the Royal Society's future policy discussions with regulators, policymakers and industry around regulation.

The evaluation at the end of the Round 1 found that 96% of participants agreed (72%, 59 strongly agreed and 24%, 20 tended to agree) that they were aware of and understood the purpose of the dialogue and their role in participating. This was despite a handful of participants in Norwich having received the wrong joining instructions about the specific focus so that they expected the sessions to be about animals rather than plants.

The design and feel of the dialogue, which made it clear that the participants' views were highly valued, and the time taken by the Royal Society and specialists to feedback played a clear role in participants' perception that the events had achieved what they set out to do. By the end of Round 2 some 94% were confident (43%, 29 strongly and 51%, 35 tended to agree) that the events would inform how scientists and policymakers decide about the future direction of genetic technology research and application, suggesting a strong feeling that the dialogues had met their purpose.

4.2 Achievement of Specific Objectives

Objective 1: Exploring commonalities and differences in attitudes depending on applications, source of the change introduced and contexts

The design of the dialogue as three parallel events, each with a deep focus on one research domain, made it possible to cover the wide scope of applications in sufficient depth within the available time. One Contact Group member reported that *"I thought this objective was taking on too much but I eat my words".* The identical design across the three locations using the same structure, mix of methods, overview material and templates for case studies made some comparisons on the underlying thinking behind attitudes possible. "*Looking at the three fields separately in the dialogues was good in helping people to work out their thoughts – all would have been too complex*". However, simply on the basis of the dialogue it would have been difficult to draw direct comparisons on the commonalities and differences in attitudes between the three spheres as only three case studies for each could not cover the full spectrum of potential applications.

The survey helped achieve this objective by using similar question formats and including a larger range of comparable applications (from cosmetic enhancements to applications with major human health implications) which made meaningful comparisons across the three domains possible. Although it was not the purpose of the research to change people's attitudes towards genetic technology applications, all the specialists interviewed were pleased to detect a cautious optimism in both the qualitative and quantitative research findings about the potential role of genetic technologies in society. In the view of one specialist the dialogues helped participants *"transcend whether genetic technology is good or bad and moved on to a much more sophisticated discussion".* Contact Group members were encouraged that *"what came through strongly was that people had hopes and aspirations not just fears about genetic technologies".*

In particular the findings suggested a more positive attitude to genetic therapies, which resonated with public engagement being carried out by individual institutes and echoed recent work by the US National Academies which makes strong distinctions between enhancements and therapies.

Objective 2: Assessing the role of genetic technologies in solving global challenges as well as those where they would prefer greater emphasis be put on other solutions

The public dialogue design attempted to look at genetic technologies through the lens of the global challenges which they could be used to solve in the short to medium term. During Round 1 participants discussed examples of genetic technologies that they had found reference to in their pre-event research. Table discussions then sought to identify the types of global challenges that these examples of genetic technologies might be suited to addressing. This proved difficult as an early task because of the very broad scope of the discussions, but did generate a long list of food system, environmental and human problems requiring solutions. The theme was picked up again in Round 2 case studies, which were presented in the context of problems genetic technologies could help address. Other potential (non-genetic technology) solutions were highlighted but, depending on the case study applications, worked to differing extents. For instance there are few ready alternatives to human genome sequencing and genetic disease therapies covered in the case

studies. In contrast, for most of the plant and animal applications/traits, conventional breeding techniques were an option and were discussed as comparators, although broader societal responses, such as reducing animal protein in-take or reducing food waste, were less discussed (although reducing food waste and improving global food distribution was highlighted as an alternative to GM crops in the Talking Heads video on Day 2). One interviewee felt that even framing challenges in the global context risked introducing a positive bias as it is easy to be supportive of technologies which will solve world problems if there are no direct cost implications.

The limited space and time within the quantitative survey meant that questions inevitably became more technology-led and it was difficult to explore the appeal of non-genetic technology alternatives to solving problems in the human and animal domains.

Largely due to the huge scope of potential global problems covered, specialists tended to agree that this objective was less fully achieved than the others.

Objective 3: Identifying the frames and contexts that moderate the public acceptability of developing UK research into genetic technologies

This objective was successfully achieved in both the qualitative and quantitative work. Specialists interviewed felt this had been a strong point of the dialogues.

Round 2 devoted a session to exploring four contexts which might moderate public acceptability of UK research into genetic technologies including: cost; individual welfare improvement; collective welfare improvement; and environmental improvement. Small groups considered each context in turn through a roving ideas storm, moving between work stations discussing and adding to previous groups thinking on what would and would not be acceptable to them. The frames and contexts that moderate opinion came through very strongly and the dialogues touched on a whole range of issues: who benefits, what they will get out of it and the caveats or governance arrangements needed to ensure that risks are managed and benefits to society at large are maximised. Some members of the Contact Group reported that these sessions confirmed their own research findings that the public is generally more interested in the ethical and societal issues around applications than the technologies themselves, although this finding was certainly more marked in the case of plants and animal food applications (potatoes, rice and salmon), than for human genome editing, and plant and animal applications with human health implications. These sessions also surfaced a widely held concern that, without government controls, genetic technologies will be captured by big business, with a tendency to make money from cosmetic applications, instead of for the greater good (including savings to the NHS), as participants would prefer. This distrust of commercialisation by business was reported to resonate with findings of individual institutes' own public engagement programmes.

The survey picked up on this theme asking whether individuals felt that genetic technologies should be used as one of the ways of addressing pressing global challenges if: there is no alternative means of delivering the same outcome; they provide a lower cost option; are less environmentally harmful; have fewer negative side effects; are subject to fewer intellectual property restrictions (e.g. patents); or are a more profitable option than existing alternatives. The survey showed that 50-60% would support genetic technologies in any of these cases except for where there are fewer intellectual property restrictions or where genetic technology is simply more profitable than alternative options.

Objective 4: Identifying who is trusted to work on particular technologies or applications, why, and with what implications

This objective was also successfully addressed in both the qualitative and quantitative research.

The final sessions of Round 2 explored who is trusted in the field through a role play and ranking exercise. Recognising that people may have little understanding of current roles played by different actors, a role play session helped clarify the existing interests and motivations of public vs. private researchers, for profit vs. not for profit commercial organisations, government, charities and foundations in the research, commercialisation and regulation of genetic technologies. A series of ranking exercises then collated data on each participant's most trusted and then least trusted top five actors in developing, informing about and regulating genetic technologies. Oftentimes these were totally symmetric but the conversations around the repetitive tasks helped to really explore people's underlying reasoning. The online survey further explored trust issues, with a focus on regulation, and showed that 70% of respondents would be positive about the use of genetic technology applications if each use were subject to careful scrutiny and regulation; and that 81% agreed with the need for a global regulatory framework for genetic technologies.

All those interviewed agreed that this objective had been well met and appreciated the more granular findings compared to previous research. *"[The dialogues] did this well and it's always nice to also have numbers to demonstrate how things have shifted*". A number of interviewees found the results pleasing in generating *"very interesting results in terms of the level of trust in academic scientists and logical reasoning for trusting them, and the high level of mistrust in business and business-funded scientists".* Neither position was a surprise to the Royal Society or Contact Group members, although scientists noted that there may still be a misconception about how both groups work. On the one hand participants may not fully recognise the extent to which academic researchers work closely with charities, foundations and corporations to fund their research; and on the other hand the level of scrutiny and regulation that plant breeders, pharmaceutical and medical companies are subject to may not have been fully clear.

Both the qualitative and quantitative research also seemed to suggest a public appetite for more information in the press and education on genetic techniques and the issues around them. This was unsurprising to most interviewees who detect a lively interest amongst the UK public for information on science and innovation (cf. the popularity of New Scientist Online 2017 exhibits on genetic technologies) but for one "*it was somewhat surprising – [there is] actually tons of information out there compared to 10 years ago – and the dialogues suggested that they know more than they think they do".*

Lessons:

- The time taken in explaining the objectives in the Talking Head Videos for Round 1 and feeding back on what specialists had learnt and how they would use it paid off. Participants in the dialogues felt very clear of the objectives, which gave them confidence about how their inputs would be used.
- The mix and sequencing of qualitative and quantitative research meant that three out of four objectives of the research have been very well met.
- The very wide scope of the study made it difficult to frame dialogues or survey questions from the point of view of global challenges and tended to over-emphasise genetic technologies rather than products/traits in the view of some interviewees. Future research may benefit from a narrower agenda (e.g. on human health issues) making it easier to take a less technology-led approach.

5. Good Practice

This section presents the evaluation findings on the design and delivery of the dialogue process and whether it has met a number of good practice principles for deliberative research, as established by the Sciencewise Programme. These include: the choice of locations and mix of participants; elements of dialogue workshop design; the balance and accessibility of stimulus materials; the professionalism of facilitation; the involvement of specialists; and choice of venues and event management.
This section also covers the quality of design and representativeness of the quantitative survey.

5.1 The choice of locations was clear and representation was of an appropriate scale and mix to provide useful results

The three locations for public dialogues were agreed by the Contact Group as providing a mix of urban and more rural audiences, and convenient for the involvement of specialists able to support the dialogue sessions. The aim was to have between 25 and 30 participants in each location who would be pre-briefed that the discussions would focus on genetic technologies in humans, plants or animals. 94% of all participants agreed that the recruitment process and advance details for the event were handled well. A small handful of participants (6 in Norwich, 3 in London) reported that their joining instructions had given the wrong topic and as a result they had initially felt under-prepared relative to other participants.

The recruitment targets and our observations of how far these were reflected in the room are summarised in *Table 5.1*. We observed that those attending the Round 1 sessions in all three locations reflected a balance of gender, age groups/life stage, ethnicity and working status. Unusually, Round 2 was held on a Friday in one location (London). There is often considered to be a risk in scheduling a week day dialogue in case economically inactive groups are over-represented and those in full or part time employment drop out. However, the contractor's prior experience suggested that enough people of all age groups in London are self-employed or work flexible hours to take part, given sufficient notice. This proved to be the case.

Table 5.1 Demographic and socio-economic characteristics of Public Dialogue participants

Sample characteristics	Recruitment targets	Evaluator Observations of participants **(R1 n82, R2 n70,** but one person each in Norwich and Edinburgh were not able to stay for the whole day**)**
Gender	50% identifying as male / female	R1: 50% male (41); 50% female (41)
Age	Good age distribution across age groups from every adult life stage	Appropriate age mix across all locations: R1 39% (32) 18-30 year olds; 35% (29) 30-50 year olds; and 26% (21) over 50s.
Ethnicity	An appropriate proportion of black and minority ethnic (BAME) participants in line with 2011 census data for each recruitment area.	Estimated 20% (16 participants) of the total of which 11 in London (39% of the sample).
Life Stage	A broad range of life stages from students, young professionals, raising young children to empty nesters and the retired (20% of sample from each category)	Our observation that all five life stages were represented and that no one group dominated in any of the locations.
Current working status	A range of people who are employed (part-time/full time/self-employed) and unemployed, plus those who are retired.	Our observation that a range of employment statuses represented in both R1 and R2, including in London where R2 was on a weekday.
Interest in genetic technologies	10% should rate themselves at 4+ in relation to their interest in genetic technologies on a scale of 1 (no interest) to 5 (very interested).	At least one person per table with some evident understanding of genetics, the regulatory context or strongly held opinions on genetic modification.

In London 26 out of 28 participants returned for Round 2 (7% drop-out rate) which was actually higher than in other locations (Edinburgh, 19% and Norwich 19% drop-out) where the second meeting was on a Saturday. In all three locations the groups looked representative of their cities for both Rounds 1 and 2.

The brief left it open to the contractors to propose whether there would be screening questions to exclude or include those with strongly held views (positive or negative) about genetic technologies. Likely views are often gauged by whether individuals are members of environmental or animal welfare campaigning groups known to have strong views on the subject. The contractors proposed a recruitment target to include those with potentially strong views: the target was to recruit 90% with no or limited specific interest, and 10% expressing some or a high level of interest in genetic technologies. The rationale for including them was to ensure that all views – including people with a medical condition that might benefit from genetic technologies and those with strongly anti-genetically modified organisms (GMO) views – would be included in the room. This was seen as particularly important given that it had proved difficult to involve stakeholders from Non-Governmental Organisations (NGOs) either as members of the Contact Group or as specialists in the room. Out of 30 recruits for each location at least one person per small table had some prior understanding of genetic technologies and the issues around them. Neither facilitators nor genetic technology specialists knew who the knowledgeable individuals were. Some members of the Contact Group were worried that this approach might introduce tensions or bias in the small groups.

The evaluation questionnaires and interviews found that vast majority of both participants and specialists interviewed in all locations were happy with the recruitment process and specialists /observers agreed that in each location the "*Wide mix of ages made it really good*" and one noted they'd met *"a great group, all good listeners, good humoured and I learnt a great deal".* The inclusion of those with prior knowledge was generally helpful to the discussions. In only one group (Norwich, Round 1) did other group members feel that an individual tried to dominate, noting that *"It's quite hard to be around conspiracy theorists as they just can't understand or listen to fact/ reason/expertise"* but participants also recognised *"However, I know you're trying to reach the breadth of society. .."*. Firm facilitation ensured that the conversation was kept on track and everyone else had space to express their views. This skill was acknowledged by a number of individual comments on the quality of the facilitation. Generally people appreciated the breadth of views and that "*Our differing views were very well represented*".

Lessons:

- With experienced facilitators to ensure that no one person dominates, including at least 1 interested participant at each table worked really well to ensure the full breadth of views were represented and heard.
- Scheduling a full day meeting on a Friday worked well in London with very little attrition.

5.2 The workshops were well designed so that the discussion flowed and there was sufficient time for deliberation

The key challenges in designing the deliberative dialogue workshops included: the breadth of the topics to be covered in the limited time available (1.5 days); some uncertainty about how much technical knowledge participants would feel they needed as a starting point for discussions; and ensuring that the findings from the three locations could be collated and compared. As noted above 10% of participants were also starting with greater interest and understanding of genetic technology issues.

The agreed design solution was to give all dialogue participants a chance to do some prior research of their own and then use Round 1 to provide a broad view of the history of genetic modification/engineering techniques and imminent opportunities across all possible applications and then – following the identical structure in each group – focus in on one research domain.

Round 1 was designed to: build participant trust in the process and develop a rapport between facilitators, participants and specialists present; enable participants to gain essential contextual knowledge of the subject so that all participants could work together effectively, whatever their initial understanding; and start initial discussions around one case study topic to lay the foundations for in-depth dialogue in Round 2. Round 2 was designed to: explore case study applications in the context of alternative solutions; explore the moderating frames and contexts for each application to be considered acceptable; and identify the trusted/least trusted actors in the field – and why this is the case.

The notable design features included:

- **The pre-task for Round 1** (bringing along something they had seen or heard about genetic technologies). Most people appeared happy to do this pre-task and generally it helped participants feel prepared (except for the handful in Norwich who had been misinformed about the research domain during recruitment and reported they felt rather under-prepared). It enabled lively warm-up discussions and generated long lists of potential applications and then global problems that genetic technologies might be applied to.
- **A two to three-week break between Rounds 1 and 2** to give the contractors sufficient time for high level analysis of findings and tweaking of designs and materials before Round 2. As a result more time was allocated to role play and ranking exercises on trusted actors in Round 2 which allowed a much richer discussion about why people do or do not trust actors in different roles.
- **A homework task** between Rounds 1 and 2. This gave participants the opportunity to reflect on what they had learnt, do their own research and test it through discussions with friends, family and colleagues. The core team and specialists felt that "*[participants] did all that was asked of them*". Overall 87% of participants rated this task as successful in Round 2 (40%, 27 very successful, 47%, 32 quite successful), but more than a quarter in Norwich were less sure (29%, 6). The evaluators observed that most participants who came back to Round 2 had fully engaged with the task and many had taken the trouble to seek out those that they felt would have opposing or interesting views. One specialist interviewee noted *"I'm impressed how thoughtful and engaged participants became"* and another with *"the thoughtfulness with which they chose who to speak to*". Many participants appeared to have had fruitful discussions which contributed to a very positive tone and more openness to the possibilities of genetic technology applications during Round 2 deliberations.
- **A wide mix of deliberative techniques** including small groups and paired discussions, plenary Q+A sessions with a specialist panel, a carousel/roving ideas storm, creative poster making, role plays, individual ranking exercises and small groups reporting back to plenary and "Any other thoughts" sheets if time ran out or for less confident individuals to contribute.

Despite the wide scope of the dialogues most participants and specialists felt there had been enough time over the two days to cover the necessary ground. After Round 1 83% of participants agreed (38%, 31 strongly and 44%, 36 tended to agree) that there had been enough time to discuss the issues, although many commented it was hard to cover such a wide range of issues but they were looking forward to going into more depth on Day 2. Timings for Round 1 were adjusted after the Norwich pilot where about a quarter of participants tended to feel there had not been enough time and that more time was needed for the specialist panellists. Minor adjustments to give more time

for panel discussions for subsequent Round 1 meetings meant that participants in London and Edinburgh found the pace more leisurely. Nevertheless, several noted that *"There'd never [be] enough time because of the subject, but [time] was never felt lacking"* while a specialist agreed *"It would be possible to discuss at whatever length! But time was very well managed".*

After Round 2 the vast majority (98%) of the 68 responding participants felt comfortable that the overall amount of time available had been about right (58%, 39 strongly agreed and 40% tended to agree) and that it had allowed them to make a significant contribution, although a few still felt that "*A bit more time for Q+A round each table would have been nice".*

By the end of Round 2 there was unanimous agreement across all participants in all three locations that most aspects of how the discussions were organised and the way discussions were managed had been successful. Several participants appreciated the mix of different engagement techniques and that each day involved a mix of sitting, standing, plenary and small group work and the opportunity to move around. Participants particularly enjoyed Round 2 activities such as the carousel and poster making, and the opportunity to present their posters to the wider group. The role play session on Day 2 was complex, but participants rose to the challenge and role play cards prompted useful discussions on the different viewpoints and motivations of actors. This in turn enabled a trust ranking exercise that Contact Group members interviewed reported to have been very useful (see Chapter 4).

As one specialist interviewee summed up, *"the structure of the two days – give them some information, a chance to talk with family and friends, ask experts questions and then debate the issues - seemed to work really well".*

Lessons:

- An experienced delivery team was able to advise from the outset that only one domain could be covered in each location, meaning that most participants felt they had enough time to cover the issues in depth.
- A good mix of techniques from single, pairs, small group and plenary activities and using different learning styles meant that everyone participated actively and all felt they had made a valuable contribution.
- Despite a three week break a carefully chosen homework task helped maintain momentum and interest between sessions and set a very positive tone for Day 2 deliberations.

Participants' views on overall workshop design

"Good structure to sessions"
"Really well thought out days"
"Really well organised and informative"
"Structured and disciplined"
"Very well organised with clear direction and objectives"
"I thought the sessions were engaging and informative and allowed everyone a chance to speak"
"Diverse engagements/activities - kept it interesting, kept blood flowing and effectively provoked new ideas/new ways of thinking"
"Very good mix of sitting, standing and breaks".
"The questions were really understandable and discussions flowed easily"
"While I had several discussions a bit more informally, I found the [homework] paper a helpful reminder, sifting out and easy to reflect back to"

Day 1 views on timing:

"Appreciated time-keeping"
"This is such as wide topic – not possible to fully discuss the issues"
"I liked that there were sheets to write down any other thoughts we had if there wasn't enough time left to discuss them".
"Wanted more time with speakers and specialists".
"Sometimes we ran out of time as there was so much to discuss
"[needed] more time"
"[Wish we had] Longer to discuss"
"Topic is broad: could spend a week discussing"

5.3 The stimulus materials presented were balanced, accessible and engaging enough for the participants to act as informed citizens

The breadth of the topic and the three parallel dialogues required a breadth and depth of material. The mix of written, visual and audio materials included: an animated introductory film, short PowerPoint presentations, two Talking Heads videos, a timeline representing the history of genetic modification, a set of nine case studies, short supporting videos and a set of role play cards. In addition participant packs included a jargon buster explaining the technical terms used during the dialogue. The short animation introducing genome editing had been produced by the Royal Society and the Wellcome Trust before the dialogues. Videos about specific case studies were taken from the internet. Given the breadth and complexity of the topics it was important that the stimulus materials were accessible, informative and clear, and provided the right amount of technical detail and context without overwhelming participants. It was also crucial that information provided was seen as impartial, presenting all sides of the argument and well-balanced between simplicity and complexity.

The Royal Society core team was responsible for selecting case studies and initial drafting of the case studies, timeline and jargon buster, with technical advice from the Contact Group. These materials were then edited by the contractor in order to ensure they were pitched at an appropriate level - comprehensive but not too detailed, complex or wordy to be accessible. The materials went through a number of iterations and were stripped back as far as possible to photos and bullet points with some hints for further reading. The contractor was also responsible for recording interviews with the Royal Society and Contact Group members, and wider stakeholders for two Talking Heads videos shown at Round 1 (introducing the rationale for the project) and Round 2 (introducing broader stakeholder views on genetic technology applications).

Major challenges in developing the materials were: deciding how much technical information to give participants and how much to leave to self-discovery; and ensuring that participants were exposed to a range of views including the risks as well as the opportunities associated with genetic modification. For each location, the Royal Society team gave a quick PowerPoint overview of the case studies, but most time was spent in small groups reviewing the materials and developing questions to ask the specialist panel in plenary. In each location one group ended up studying the same case study on both day 1 and day 2. There were some concerns that this might have been boring for the participants, but in the event they appeared happy to discuss the issues arising in much greater depth on Day 2.

Despite significant time spent by the team, it proved difficult to get NGOs who had historically cautioned against the use of genetic technologies, especially in agriculture, involved in developing the materials. Providing a balance of views was therefore mainly addressed via the structure of the case studies (which looked at pros and cons of each application), featuring quotes from different voices on the time line, and reflecting different voices in the Round 2 video.

The vast majority of participants and specialists interviewed agreed that they had enough information and the stimulus materials were balanced, accessible and engaging. By the end of Round 1 over 91% of the 81 participants who responded agreed (44%, 36 strongly and 47%, 38 tended to agree) that they had been provided with enough, clear information to enable them to contribute to the discussions. No one reported that there was too much information or that it was too complex or difficult to understand. On the contrary, a handful of participants in Norwich (5) and London (2) commented that they would have welcomed even more information either on the night or before the event (see box below). Such comments are unusual for dialogues where people more often report that there was too much information to digest. This may be reflective of the fact that 10% of the group already had some prior interest and may have been hoping for more in-depth

information, but several commented that they had filled the gap by doing some independent research.

There was almost unanimous agreement (94%) after Round 1 that the information provided had been fair and balanced. Specialists tended to agree. "*The information presented on genetic technologies in general (presentation, video, timeline) seemed fair and balanced*". Only two participants – both in Norwich - felt that negative or anti-GMO views on plants hadn't been fully represented. This may have been partly because the timeline was difficult to see because of poor lighting. In subsequent meetings the timeline was more prominently displayed and anti-GMO views were given prominence in the Talking Heads video on Day 2.

After Round 2 the vast majority of participants in Norwich and London strongly agreed or tended to agree that the way information had been presented was successful. In Edinburgh half the participants were less convinced (4 tended to disagree and 7 were unsure) which seems to reflect problems with the audio visual facilities at the venue and the poor sound quality of videos. 10 participants specifically commented on the difficulties on hearing the videos (See Annex B).

Lessons:

- Effectively three parallel work streams necessitated the development of a lot of stimulus materials. The co-production approach with the Royal Society leading on technical content and the contractors focusing on presentation and accessibility worked well. However, the lack of a direct link between the contractors and Contact Group, led to an extended drafting and approval process. Setting up a small sub-group of interested Contact Group members to work directly with the contractors on drafting could have streamlined the process within tight deadlines.
- Stimulus materials were well received by participants. Most felt they had sufficient information. Not all available resources were fully used (particularly the timeline and jargon buster) but it was useful to have materials in reserve. A handful in each location would have liked more information, but the three-week gap allowed them to do their own research if they wanted to.
- Although it proved difficult to involve those with anti-GM views as specialists in the room or in the drafting process, participants generally perceived materials as balanced.
- The cost compromise of recording the Round 2 Talking Heads video resulted in poor sound quality for some interviews. This made it difficult for some participants to hear in one venue with faulty Audio Visual equipment.

Participants' views on the availability of information, Day 1

"Good handouts, excellent speakers"
"I think it also helped highlight how little we do know"
"More information on GM technology was needed".
"Actually I could have had more basic info in advance which would have helped - a fact sheet perhaps?"
"Not as much information was given out as I would have liked"
"More info needed to make specific comments but academics were very helpful"
"I had reasonable knowledge beforehand but info on the day basic - although fully clear"
"Not enough [info]"
"Too big a subject to provide clear and concise info"
"Felt I was given direction but no detail, did my own research"
"Enough space for own thoughts"

5.4 The facilitator team was professional, well-briefed, consistent and unbiased and enabled all participants to make an active contribution

The contractor team was made up of three senior facilitators who attended all six dialogue workshops and stayed with the same small groups of 7-10 participants for each round. The team did not include separate note takers.

We observed excellent facilitation with a good ratio of facilitators to participants, enabling warm and lively, but focused, discussions with good time-keeping. The time spent building trust during Round 1 sessions meant that groups really gelled during Round 2. We observed that in all nine small groups everyone contributed and, although some people had more to say than others, the facilitators did not allow any individuals to dominate the discussions and were very good at bringing quieter people into the discussions. The mix of working in pairs, small groups and presenting back to plenary reinforced this. Sensitive but firm facilitation of a couple of potentially disruptive participants ensured that they did not dominate at the expense of others in their groups.

In all three locations participant were unanimous in finding the facilitation independent, professional and effective (Norwich 81% strongly agreed 19% tended to agree; London 69% strongly agreed, 31% tended to agree; Edinburgh 76% strongly agreed, 24% tended to agree). Comments shown in the box below suggest that one person's view that facilitation was a *"Big strength of this event"* was widely held. There was also almost unanimous agreement in all locations that participants had been able to contribute their views and have their say. A few participants found "Any other thoughts" cards useful for raising issues and questions for the next session with one participant noting "*I liked that there were sheets to write down any other thoughts we had if there wasn't time left to discuss them*". Written and verbal comments from individuals in all groups praised how the facilitators helped create strong group dynamics, kept discussions focused and on time, and managed potentially challenging individuals appropriately.

The facilitation team made considerable efforts in Norwich to include a participant suffering from a neurological condition, including contacting the Tourette's Society to seek advice between Rounds 1 and 2. Given the opportunity to introduce himself to the whole group and explain his condition and to take breaks when needed, his outbursts were handled sensitively, did not prove disruptive for other participants and allowed him to make valued inputs to the discussions. When he had to withdraw half way through Day 2 due to ill health his facilitator took the time to update him on the sessions he missed and ensure that his reflections were included in the final report.

Lessons:

- The style of facilitation and continuity between events and sensitive handling of individuals with special needs or who tended to dominate, led to a very positive dynamic within small groups and a unanimous feeling that all participants had found their voice and been heard.
- Using a range of participant feedback techniques (in pairs and small groups, use of flipcharts, posters, 'any other comments' cards and annotation of the timeline, audio recordings of small table discussions and vox pops with participants) produced a richness and depth of findings with a cost effective facilitator:participant ratio (up to 1:10).

Participants' views on the quality of facilitation

"Really great team dynamic was created early on"
"Facilitator moved the discussion on for time purposes - very well managed"
"Facilitators made sure everyone was able to contribute"
"Facilitator managed to control one person from taking over well".
"Didn't feel any bias/influence"
"Kept us on track and topic"
"Facilitators - amazing job"
"This was fantastic - all views heard and considered."
"We were all given the opportunity to talk"
"Facilitator ensured everyone had a voice"
"We all had a chance to say our view"

Views of Specialist panellists:

"I thought the whole thing was outstandingly well facilitated"
"Very professional. They were very approachable: it felt like a very collaborative process"
"It really helped that they had such a senior team working on all aspects from design to project management."

"Even when I felt silly I was made to feel listened to"
"Everyone had a chance to air their opinions"
"Well facilitated with clear instructions and information"
"Great to have been given a voice"

5.5 Specialists were involved to provide information and trust in the process

21 specialists and observers (5 Contact Group members, 6 scientists/ethicists from other institutes, 7 Royal Society staff (including two interns), and 3 observers from the Chinese Academy of Sciences) took part in at least one of the six dialogue workshops. After the Round 1 pilot in Norwich, efforts were made to ensure that both research scientists and ethicists were included in every meeting, with at least one specialist (and often two) per small group table. For some meetings the number of speakers and observers was large relative to the number of participants (for instance five speakers and four observers amongst a group of 22 participants at Norwich Round 2 and seven amongst 22 in Edinburgh).

During the scoping interviews with the contractors, several Contact Group members with previous experience of deliberative dialogues had highlighted concerns that scientists might be tempted to talk too much and see their role as educating and convincing the public of the benefits of genetic technologies. This risk was addressed by designing a very clear role for specialists as panellists in Q+A discussions, providing feedback on what they had learnt in the final sessions and in listening mode at small tables. The listening and learning role was reinforced through clear written and verbal briefings for specialists and observers before each session and a debrief session immediately after. During both Rounds 1 and 2 small groups discussed their case studies and jointly chose two questions for each table to pose to the specialist panel.

Specialist panellists interviewed confirmed that they felt very clear and comfortable in their role in both small groups and plenary Q+A sessions. Several noted that "*it was good to be able sit in and observe the discussions and just listen"* or that *"it's good for scientists to understand how quickly people home in on the wider issues and how little we actually need to explain*". One of the panellists remarked that "*the way experts were brought in was very professional*".

Despite the different mix and number of speakers/observers in each location participants almost all agreed by the end of Round 1 (67%, 55 strongly, 24%, 20 tending to agree) that they found the speakers helpful in answering questions and that having specialists/observers present did not disturb them. Even at events with large numbers of specialists/observers people reported that *"They were not intrusive, were helpful".* Several participants noted that they also enjoyed the opportunity of talking to the Chinese delegates. Participants valued the speakers as knowledgeable but very approachable. "*They did an amazing job sometimes adding their input into conversation, while informing others*". Many seemed very comfortable to approach specialists with individual questions during breaks. The feeling that *"I never felt silly or shy to speak"* seemed typical.

The Q+A process with each small group generating two questions worked well in all locations. Contrary to expectations it tended to generate broad societal questions about risk, ethics and regulation of genetic technologies rather than the anticipated technical and jargon busting questions about the underlying science. During the pilot session in Norwich, there was no social scientist on the panel and the timing for the Q+A session was tight. Some participants therefore felt that broader questions went unanswered, and that the answers were too general, noting the *"limited time to put individual questions to speakers"* and *"it was difficult within the timing and the large*

group setting to ask questions". However, for all subsequent dialogue workshops the mix of experts was adjusted to include an ethicist and more time was given to questions. By Round 2 participants in all locations were visibly relaxed and confident about asking questions in plenary. There was a consensus amongst specialist panellists, the Royal Society staff and the contractors interviewed that more plenary time for the Q+A panel on Day 2 would have been valuable, but this could only have been achieved by reducing time spent on one of the small group discussions.

Lessons:

- Careful briefing (written and before sessions) by the facilitators ensured that specialists were comfortable in listening mode. Participants were treated with equal respect as the specialists and visibly grew more confident in asking questions and challenging the answers they received.
- The plenary Q+A sessions which identified two priority questions from each table worked well to surface the big issues and avoid duplications but would have warranted more time.
- The closing reflections from the experts on what they had heard and learnt helped to reinforce participants' sense that their inputs were valuable and would be used by the Royal Society and policymakers.

Participants' views on the role of specialists:

"Fascinating speakers"
"Most questions were answered"
"I liked that the speakers answered questions they were able to answer and did not try to make up answers to questions they were unable to answer"
"It was great having experts and even scientists here to answer questions"
"I am very impressed by the organisation and the experts involved"
"The experts were very knowledgeable and essential to making this workshop work"
"Speakers were excellent but some topics were too broad to be answered in detail"
"Interesting to have scientific and philosophical viewpoints"
"There is kind of a longer feedback loop than a direct Q+A, some1 or 2 questions may have been dropped but it actually was well-integrated into the rest of the session"
"More time needed for speakers"

Specialists views on their role:

"Certainly the groups seemed to enjoy the chance to ask experts questions, but we were not there to grandstand, and interesting [to see] how little experts need to say really"
"Everyone seemed to understand they were there to listen and only respond when called on"
"Briefing materials excellent"
"As an observer an opportunity to sit in on the small groups without participating was really valuable. Often it's much more like a Q+A session"
"The facilitators were great in how they managed and briefed the experts"

5.6 Organisation and Venues

The chosen venues were all art or community centres rather than dedicated business meeting spaces. All were central, easily accessible by public transport, and welcoming with plenty of break out space that helped create a fun and informal atmosphere. However, in both London and Norwich the Round 2 full day events had to compete with other noisy users in adjoining rooms and in Edinburgh the poor quality of Audio Visual (AV) equipment provided at the venue made it hard for many participants to hear the Talking Heads videos during plenary sessions. Overall, however, a widely shared sentiment was that this was "*a very well organised event*" and "*even the food was good".*

Lesson:

- Venues need to be neutral, accessible and welcoming but also conducive to serious discussions with reliable AV equipment.

5.7 Online survey was nationally representative, flowed well and built on the findings of the public dialogues

In order to cover the wide range of specified demographic characteristics - gender, age groups, type of household and number of children, average household income, education level, type of employment, ethnicity, regional coverage and religious affiliations - a relatively large sample of 2061 respondents was need to achieve a small 95% confidence interval. This sample was at least twice the size of quantitative surveys previously undertaken by the Royal Society and other institutes as part of similar research studies (footnotes to Chapter 10).

Within the available budget the contractors chose a relatively novel approach of using an online survey platform where respondents could either sign up themselves or be sent a direct invitation to ensure that the target demographics were reached, rather than through Computer-Assisted Personal Interviewing (CAPI) used by specialist survey companies. Surveys on the Toluna platform are typically 15-20 minutes long with a maximum of 50 questions. *Table 5.2* summarises the demographic and socio-economic characteristics of the sample (elicited through about 24 questions) and the extent that this is representative of the UK adult population, based on comparison with Office of National Statistics (ONS) census data.

The survey design was led by the contractors based on their early analysis of the findings of the three dialogue work streams. Advice and suggested amendments were fed in by the Royal Society core team, and a small number of Contact Group members and the evaluator. Near final versions were piloted online with small groups of non-specialists and the core team to ensure there was sufficient contextual information, the questions flowed logically, the wording was understandable and the timing worked.

There were a number of challenges in designing a 20 minute/50 question survey with such broad scope, namely:

- The tight timeline, which allowed very little time for analysing the Round 2 dialogue findings and their implications for the shape and framing of the survey;
- Providing sufficient background information so that respondents could understand while avoiding inaccessible technical language;
- The ambition to allow cross-comparisons across domains generated a long list of potential techniques, traits and applications far in excess of the 9 covered in the case studies and could have led to a very repetitive design.

Fine-tuning the structure, coverage, language and length of the survey required 11 iterations and was more time-consuming that the core team or contactors had expected. But the resulting survey proved very effective in generating fully completed responses from the specified target group within a tight timeframe. By the close of the survey 2061 individuals had responded, many of them within the first three days. As for the qualitative research the recruitment targets were met for all key parameters. Findings have been presented for the whole sample and also disaggregated by religious affiliation and age.

An interesting contrast to the dialogue samples was the level of self-declared interest in science in general and genetic technologies in particular. 70% of the online sample described themselves as interested (24% very interested, 46% fairly interested) in genetic technologies, compared to the 10% quota in the dialogues. This seems high, particularly in light of the fact that only 28% of respondents reported that they had seen/read/heard (on the news, in a paper or on social media for example) any information on genetics or genetic technologies in the previous month. This may reflect a

growing interest in emerging technologies amongst the UK public (which other institutes report from their own public engagement) or a tendency for those with a real interest in the topic to be early responders to an online survey. If the latter was the case then the largely positive responses to different applications of genetic technologies may be over-stated relative to the views of a less techy audience. However, it also seems likely that there was a tendency for people to exaggerate their interest, perhaps suspecting that by saying they had no interest they would be screened out as respondents.

Table 5.2 Demographic and socio-economic characteristics of online survey respondents

		Survey sample	UK average
Age Group	18-34 35-54 55+	31% 35% 34%	Broadly representative of UK ONS with slightly more 18-30s and slightly under 55+ age group but did include some over 80s (13) who might have been hard to reach.
Gender	M F	48% 52%	Women slightly over represented (F 50.9% nationally).
Location	South Midlands & Wales North & Scotland Northern Ireland	44% 21% 32% 3%	Broadly representative of UK population distribution with no over-representation from any specific postcodes.
Employment	Stay-at-home spouse, retired, student or unemployed	45%	Economically inactive may be slightly over-represented (69.5% economically active, 30.5% economically inactive 16-74 age group according to ONS 2011). This may reflect the different survey age sample (18 to 98) and people may be both students and part-time employed.
Number of people in the household	1 2 3 4 5 6+	18% 34% 20% 16% 6% 4%	Closely representative of the make-up of UK households in 2011 (of which 52.6% were single or couples without children).
Ethnicity	All non-white British including mixed	11%	Broadly representative of the UK population of whom 12.6% (including under 18s) identified as BAME in 2011.
Average Annual income	<£10,000 £10-14,999 £15,000-19,999 £20,000-29,999 £30,000-49,900 £50,000 + Don't know, didn't answer	9% 10% 11% 20% 25% 17% 7%	Sample representative of 50% of households below the UK Mean equivalised household disposable income of £32.25k (2016/17) and of the upper income quartiles (41.8% above the mean level with some representation of all higher bands including >£200K). 7.4% did not know or wish to answer this question.

Source: Office National Statistics, 2011 census and other datasets

Lessons:

- The online platform proved an effective and affordable means of achieving a large nationally representative sample within a tight deadline.
- Both the Royal Society and the contractors under-estimated the time needed (elapsed and person days) to digest the findings from the final dialogue sessions and craft a survey that met all the framing, information support, ordering and technical language challenges.

6. Satisfaction

This section evaluates whether participants were satisfied with the dialogue process and whether the Contact Group and the Royal Society were satisfied with the overall study. In addition to the feedback on whether the public enjoyed taking part we have attempted to assess the value of the process, over and above the knowledge that they gained (see section 8), to the participants.

6.1 Participants

All of the participants responding to the evaluation questionnaire and interviewed informally thoroughly enjoyed taking part in the dialogues. Positive group dynamics from the outset and the perception that they had learnt something new meant that one vox pop interviewee's feeling that *"[it was] pleasantly interesting and actually entertaining …. I really enjoyed the evening"* was typical by the end of Round 1. There was widespread agreement by the end of the first evening that the session had been interesting, informative and thought-provoking and these words were used consistently by participants asked to sum up their experience in three words as shown in *Figure 6.1*. A few also reported that they had found the evening challenging, provoking or frustrating but also enjoyable, engaging and fun. All those informally interviewed by the evaluators (about 20) were looking forward to the next session.

By the end of Round 2 variations of the view that it was *"just so interesting and thought-provoking, I really enjoyed myself"* were shared by many. In all three locations people enjoyed working in mixed groups and learning from each other.

Figure 6.1 Word Cloud describing the participants' experience of Round 1 across three locations

By the end of Day 1 almost all participants agreed that they had learnt something new, including the few who had started off with some prior knowledge about genetic technologies or regulation. Most of those interviewed told the evaluators that they had known very little about genetic technologies

before the session, but they already felt they had learnt a lot about the technical aspects and wider issues during the sessions and their own research for pre-homework. The extent and pace of genetic technologies development and the potential range of beneficial applications made a great impression on many. Participants also commented on the complexity of the decisions facing society and how much more there is still to learn (both personally and for researchers). Discussions highlighted that many participants started with very little knowledge of how risk is assessed, the governance of research and how genetic technologies are regulated. This was reported as a frustration by a few participants who felt "*much time was taken up by people asking about regulation, not knowing there are already regulations in place*" or that "*debate can only be valuable if people are aware of the issues and current situation, otherwise you just have people debating in the dark*". Partly in response to these comments the stimulus materials for Round 2 placed greater emphasis on explaining the current regulatory context for each research domain (PowerPoint presentations and timelines) and within each case study than previously planned. Time was also allocated in the final sessions to thinking about what good regulation might look like.

By the end of Round 2 there was complete agreement amongst all participants in all three venues (91%, 62 strongly agreed while 9%, 6 tended to agree) that overall they had enjoyed taking part in the dialogues. Many also took the trouble to give the evaluators additional written and verbal quotes about how much they had enjoyed taking part, how much they had learnt and how much they valued the opportunity to be involved in important decisions facing society.

High levels of satisfaction with the process by the end of Round 2 translated into all participants agreeing (90%, 61 strongly agreed, 10%, 7 tended to agree across the 3 locations) that they are likely to get involved in these kinds of events in the future. Indeed about 10 participants specifically noted on their feedback forms or told the evaluators that they would like to continue being involved with the Royal Society public engagement processes in the future. This is a very strong endorsement of the way the dialogues were designed and delivered and their belief that the process would have value to the Royal Society and others. Indeed one participant remarked that *"… even though we thoroughly enjoyed it, what we brought to the discussions i.e. strategy, insight and content analysis warrants much more remuneration*".

It was not possible to follow up with online survey respondents to check whether they were satisfied with their involvement. However, the fact that total responses exceeded the target number, that all responses were fully completed and that an average of 90% of respondents were able to give a considered answer to each question suggests that they found it interesting and understandable.

Participants' satisfaction with taking part in the dialogues

Round 1:	**Round 2:**
"Thoroughly enjoyed the workshop"	*"My time here has been so educational and uplifting. It was good to be given the chance to speak and have an opinion"*
"I found the discussions very enjoyable and not something I would normally do in a group situation"	*"A great experience"*
"Always really interesting, looking forward to coming back for more ..."	*"Really enjoyed taking part"*
"Was great, looking forward to the next session to find out more"	*"Really enjoyable thought-provoking sessions"*
"I really enjoyed being able to put my opinions across on something that affects me"	*"Enjoyable and educational"*
"I'm looking forward to the next workshop, due to the amount of info and feelings that came to mind after today"	*"Very interesting and it felt good to be involved in important decisions!"*
	"The fascination of being part of not only my own evolution but human evolution is exciting"
	"Really loved the two sessions and would love to take part in the future"
	"Very engaging and informative, would be willing to contribute going forwards"
	"Please contact me for future discussions. I really enjoyed myself"

6.2 Specialist panellists

The specialists who took part as panellists and observers in the dialogue were also overwhelmingly satisfied with the events (the 8 who responded to the question strongly agreed that they were satisfied with the event they took part in). Those involved described the dialogues as very well done, fun and worthwhile.

Generally those interviewed by the evaluators had had some prior experience of public dialogues or public engagement around their research interests but welcomed the chance to observe and hear what the public had to say. Many interviewees did not feel that they had heard anything startlingly new or surprising in the dialogues but what they did hear tended to validate outcomes from studies in related fields and their own discussions. But interviewees did report that taking part in the meetings had reinforced their understanding about how little scientific education the public at large needs from experts in order to make a valuable contribution to the debate. Most were impressed with the speed at which groups got to grips with knotty ethical and societal issues for their research domain. And also how seriously they took discussions about the potential benefits, costs and risks around different applications. The view that "*It was really nice that participants felt their views were of interest and would make a difference*" was typical of those interviewed.

Contact Group members and the Royal Society team also felt that the online survey had been a valuable part of the research, pulling the three strands of the dialogues together, validating a feeling that the public are becoming more positive about genetic technologies for certain applications, and providing useful evidence on their expectations of regulation.

Views of specialists and observers on the dialogues

Satisfaction with the process:

"Incredibly worthwhile and lots of fun. A very memorable exercise"
"Overall very impressed – we've got to a very good place"
"Deliberative workshops were fantastic – discussions on the whole were managed very well by HVM"
"Very thoughtful, very polite discussions that picked up on the issues – group dynamics worked very well"
"I sat in on discussions of all three groups and although the dynamics seemed to differ a little the level of discussion was very good"
"I hadn't previously been so closely involved in high quality qualitative work and it was very well done"
"Overall very happy with the process"

What specialists learnt from taking part

"Impressive how the participants got their heads round the complexities of going from research to regulation"
"It was really humbling how seriously people took the dialogues and how appreciative they were of the opportunity to share their thoughts and have their say"
"I've learned a lot from the face to face discussions and interesting to see how public opinion has changed"
"I was there as an expert – not talking about what I think - and a great lesson in how little [experts] really need to say"
"Eye-opening, deep, a beginning"

Lessons:

- Vox pops with 18 participants were an effective way of describing the journey that participants had been on and an engaging way of presenting their hopes and fears for the future of genetic technologies and what they would like to see the Royal Society doing with the results.
- The keenness of some participants to continue being involved suggests that, subject to meeting data protection requirements, the Royal Society could continue the dialogue with a small panel of informed citizens around these issues in the future. All participants should be sent a copy of the final report. The evaluator would be happy to provide contact details for those who indicated that they were happy to be contacted again.

7. Governance

7.1 Contact Group

The Contact Group's remit covers the whole genetic technologies programme of which the dialogues/opinion survey are one strand. A few individuals with specific experience of dialogues took an early role in helping the Royal Society develop the early concept, shape the terms of reference and the overall framing. Most members were recruited once funding had been secured and the brief was finalised.

The Group was expected to meet three times over the life of the study. The first meeting approved the overall framing through a genomics and genetic technologies lens set in the context of global problems that the technologies could potentially address. It also approved the contractors proposed design and suggestion of three locations each focusing on a different research domain. The second meeting received a presentation of the study findings by the contractors and discussed how the outputs would be published. The third meeting, planned for after publication in March, will consider how the findings should help shape the Genetic Technologies programme and feed into wider policy and regulation discussions.

Since the dialogues and opinion study is only one part of the Contact Group's overall remit, and to minimise how often individuals were contacted, the relationship between the contractors was mediated by the Royal Society core team. The core team presented members with stimulus materials and the online survey for review and collated comments from the Contact Group to pass back to the contractors. 13 of 18 Contact Group members have input to the process through scoping or evaluation interviews. About half have taken an active role in reviewing, editing and suggesting amendments to dialogue/survey design and materials. Six attended one or more dialogue workshops as specialist panellists.

The Contact Group membership provides a good mix of academic (research scientist and social scientist), policy and funding perspectives but has not involved NGOs with a specific interest in genetic technologies, as might normally be expected for a citizen dialogue oversight group. This reflects reservations on the part of both academic research and civil society communities. Academic Contact Group members expressed some concerns that, based on their behaviour in other forums, NGOs with an interest in GM/GT would hold strong and immovable negative views which could bias discussions. On the part of NGOs there has been a reluctance to get involved due to the perception that the Royal Society's past stance (e.g. on GM plants for food) has been too overtly positive. Partly to address this deficit, after the first Contact Group meeting the Biotechnology and Biological Sciences Research Council (BBSRC) and the Contact Group Chair pushed for an independent evaluation of the process to help ensure that the need for balance was addressed in design and delivery. The Royal Society core team and the contractors also made considerable efforts to involve NGOs as specialist panellists in the room or to include their voices in the Talking Head videos for Round 2.

All Contact Group members interviewed for the evaluation agreed that the Contact Group has been well chaired, has been efficient in making decisions, and a cost effective use of their time. They all felt that their views had helped to shape the research. Several who were unable to attend meetings had been briefed separately by the Royal Society core team and had been able to feed in views. As noted in Chapter 5, the contributions of Contact Group members as specialist panellists answering small group and plenary Q+A were a key element in the success of the dialogues and participants'

belief in the process. All Contact Group members interviewed felt that their time inputs had been commensurate with the value that they expect the study to add to the Royal Society's programme.

Views on the Contact Group by its members

"Very well chaired meetings"

"Really useful meetings and a good use of my time because of the mix of really senior people – scientists and others – from different disciplines and views"

"Very cost effective use of my time"

"Good consultation with opportunities to shape the materials"

"The Royal Society team ensured that members that could not attend a meeting were briefed and sought their opinions on the issues arising"

Lessons:

- A large Contact Group with a wider oversight role of the Royal Society genetic technologies programme has taken a key role in framing the research, harvesting past experience of running public dialogues and quantitative surveys, and fielding specialist panellists for the dialogues.
- Strong chairing and secretariat support by the Royal Society core team proved efficient in terms of managing time demands on individual members so that they felt their time was used effectively. However, not having a direct line between the Contact Group and contractors during the intensive materials/survey development stages slowed the process of signing off materials to meet tight deadlines.
- An alternative approach might have been setting up a small sub-group with the handful of members who wanted a very active role in materials design. Arguably this might have operated at a level at which NGO involvement would have felt more comfortable.

8. Impact

This section considers the early impact of the project and its potential future impacts in contributing to the Royal Society's wider objectives in engagement with the policy, research and business communities. Section 8.2 looks at the immediate impacts on the participants in the dialogues while Section 8.2 focuses on potential impacts on UK and international policymakers and the genetic technologies research community.

8.1 Impact on Participants

Although it was not an explicit objective of the dialogues, taking part in the process certainly had some immediate impact on the participants. At the outset only 10% had a stated interest in genetic technologies: by the end of Round 2 many participants commented informally and on feedback forms that they now had a real interest in the technologies, applications and the ethical and socio-economic choices that society faces. As noted in Chapter 5, 70% of respondents to the survey said they already had some interest in genetic technology.

By the end of Round 1 all but two participants reported that they had learnt something new about genetic technology (81% strongly agreed, 16% tended to agree) as a result of taking part. The two who felt they had not learnt something new were those who already considered they knew quite a lot. At the end of Round 2 participants were asked how much they felt they knew about genetic technology before the meetings, and then how much they felt they now knew about the following specific areas:

- What genetic technology in (humans/plants/animals) could be used for?
- The possible benefits of using genetic technology in (humans/plants/animals)?
- The possible problems of using genetic technology in (humans/plants/animals)?
- Who is responsible for making decisions about genetic technologies used in the future?

Across the three locations at least 70% of participants (70% in Edinburgh, 73% in London, 81% in Norwich) reported they initially knew very little about genetic technology: only two felt they knew a lot, while 22% (15) felt they knew a fair amount. Written and verbal comments from participants suggested that even those who felt they knew a fair amount, came to the conclusion that they had known less than they thought or had access to less balanced information than they'd thought.

By the end of Round 2 the vast majority of participants reported that they had learnt quite a lot and had real confidence in the validity of their opinions. Specialist panellists also noted that they picked up the essence of the topic quickly "*I was very impressed to see that the public, when shown that we are interested in their opinions and given the space, got their heads around the issues very quickly*". The majority of participants (100% in London, 95% in Edinburgh, 86% in Norwich,) reported that they now knew a fair bit or a lot about what genetic technologies could be used for in the human/ animal/ plant domain they had studied. They also understood the possible benefits and possible problems. Across the three locations most participants surveyed appeared to move along a scale from knowing very little to knowing a fair amount, or from knowing a fair amount to a lot. In each location a small handful jumped from feeling they knew very little to a lot. The box below summarises some of what participants reported they had learnt in each location.

Although the regulatory regime was discussed in the Royal Society's presentation, in all case studies and in the afternoon sessions of Round 2 (where groups identified who they would want to see involved in regulation in the future) this was still the area where the participants generally felt least informed. In each location a sizeable minority (29%, 6 in Norwich) still felt they knew very little about who makes decisions about research or use of genetic technologies and only 13% (9) across all three groups felt they now know a lot about this area.

It was not possible to evaluate the impact that taking part in the online survey has had on respondents, but as noted in Chapter 6, 90% of respondents appeared to understand the technical questions and gave considered answers. The only questions with high "I don't know" responses were related to questions such as whether regulation should focus on outcomes rather than the method to deliver that outcome, which dialogue participants with access to experts and each other's knowledge also found difficult to answer.

Lessons:

- The stimulus materials for the dialogues were pitched at the right level for the audience. The jargon buster, further reading suggestions, homework task and access to scientists and ethicists who treated them as knowledgeable in societal issues meant that almost all participants felt they had learnt a great deal.
- The research was not initially expected to focus on regulation but, as participants' interest and 'need to know' became clear from the first dialogue session in Norwich, design and materials were amended to give more emphasis to regulation during the dialogues and online survey. This is also an area where the Royal Society and others could do more follow up in the future.

What participants learnt from the dialogues

Norwich – plant genetic technology:
86% of participants felt they'd increased their knowledge about plant genetic technology with 12 moving one level and 6 from a little to a lot, 1 still felt they knew very little. More than a quarter (29%, 6) still felt they knew very little about who makes decisions about genetic technology research in plants. Typical comments included: "*I feel much better informed*" and "*It's an exciting topic*" to "*This is a huge topic - on the whole, I still know very little!*" and "*I can still see the huge complexities, and that's OK!*"

London – Human genetic technology:
Participants all reported increased understanding of how genetic technology could be used in humans, the possible benefits and possible problems: 85% (22) moved up one level (from knowing very little to quite a bit, or from quite a bit to a lot) while 15% (4) moved from feeling they knew very little to now knowing a lot. The majority also felt they understood more about who is responsible for making decisions about use for humans in future (77% knew a fair amount, 8% a lot) but 15% still felt they knew very little. Typical comments included: "*This workshop made me tick "I know a lot"*" to "*Impossible to know a lot as Joe public, but it's been very informative*" and "*I still don't know who is responsible, I guess it hasn't been decided yet*".

Edinburgh – Animal genetic technology:
In Edinburgh only 2 individuals initially felt they knew a lot about genetic technology in animals, but almost half (10) felt they knew a lot about potential uses, benefits and problems by the end of Round 2. One individual still felt they knew very little. When it came to understanding who makes decisions most felt they now understood a fair amount and 5 felt they now knew a lot. A handful (3) still felt they knew only a little. The following remark was typical: "*I found it interesting and want to know more*".

8.2 Potential Impacts on Policymaking

The final research report will be published on the Royal Society's website on 7 March and will be linked to two events:

- Industry – 'Transforming Our Future. A meeting organised by the Royal Society's Industry team on CRISPR as a technology. The report findings will feed into relevant sessions.
- Public – An evening event presenting some of the findings of the public dialogue.

The Royal Society also plans to produce communications materials based on inputs to the dialogues and the findings from the dialogues and survey. These are going to include an infographic on genetic technologies and human health, which will draw on the timeline and case studies, and a public event to open up the debate to a wider public. Contact Group members have suggested that findings/material could also be shared internationally (e.g. with the US Genetic Literacy website). The March meeting of the Contact Group will also identify how the research findings can be used to inform public and policy debates more widely. 'Transforming Our Future.

If, as seems likely, the Royal Society decides to undertake more work on genetic technology it is not yet clear whether it will be technology or challenge-led, and whether it will be across all three research domains or have a tighter focus e.g. on human health.

UK and EU policymaking

The Royal Society has a role to help inform Government and Parliament about regulation and has recently made submissions to the House of Commons Science and Technology Committee on Genomics and Genome Editing[1] inquiry on future opportunities and risks and potential directions for regulation. In its evidence, the Royal Society noted that "*The UK might present an interesting case study in the next few years as it leaves the European Union. In doing that, it may look to reshape the aspects of its regulatory system that apply to the commercial production of genetically modified plants and animals*". As part of the overall genetic technology programme, this research can help inform the Royal Society's recommendations about future research and policy actions that may be necessary for the exploitation of future opportunities, for the UK to remain at the forefront of the genetic technology field, and for risks and uncertainties to be addressed.

All the specialists interviewed for this evaluation agreed that the combination of qualitative and quantitative findings will provide useful evidence in any future discussion with policymakers and regulators about genetic technologies in plants and animals for food. The survey findings that appear to show more support for some genetic technology applications, and initial findings on reactions to different styles of regulation are seen as timely from both a UK and international view point.

There is currently lively debate about regulation of genome edited plants and animals for food at European and international level. Both the US and German governments are reviewing the evidence about whether CRISPR/Cas9 (which enables tiny, precisely targeted changes to a gene that are indistinguishable from natural mutations) should continue to be regulated as genetically modified organisms or by their end traits. The European Court of Justice's Advocate General has given the formal opinion (January 2018) that crops and drugs developed using precise genome-editing techniques like CRISPR/Cas9 may not need to be regulated as strictly as genetically modified organisms, as they currently are in Europe. Contact Group members feel that the findings from the research appear to suggest more acceptance from the UK public of these types of applications.

In the human domain, there may also be changes on the horizon in the regulatory context for genome editing. In the UK editing of somatic (non-reproductive cells) in a research or clinical context is regulated under the Human Tissue Act, 2004 and is overseen by the Human Tissue Authority (HTA) which regulates issues relating to human bodies, organs and tissue for research and transplantation. Somatic therapies (e.g. where cells are removed from a patient and edited in a lab to correct a harmful mutation) are licensed by the Medicines and Healthcare Products Regulatory Agency. Research on human germline editing is permitted on embryos up to 14 days but therapies to apply germline editing to heritable diseases would require a change in the legislation. A review of this

[1] House of Commons Science and Technology Committee, 2017,Genomics and genome-editing: future lines of inquiry

legislation is considered a likely part of any post-Brexit regulatory agenda. Findings from this study and any subsequent follow up work could provide important evidence to any such review.

International policymaking

The findings on UK public opinion will feed into the Royal Society's collaborative work with the Chinese Academy of Sciences in understanding the commonalities and differences in national regulatory systems. The Royal Society has already worked with the US National Academy of Sciences on synthetic biology and gain of function, and with both the science academies of the US and China on human gene editing[2]. The findings on UK public opinion about the type or regulatory framework favoured for plants and animals consumed as food will be of interest to Chinese researchers involved in close to market applications such as GM rice. The survey found that 80% of respondents (47% strongly agreeing and 33% agreeing to some extent) felt that stricter testing and regulatory regimes are needed for genetically edited plants for food than conventionally bred plants. Sharing lessons about the costs and benefits of running public dialogues may also be of interest.

The study's findings on who is trusted to undertake, share information on and regulate research, and the preferred approaches to regulation in different domains could also feed into international level discussions (e.g. around the Convention on Biological Diversity) which individual Contact Group members are closely involved with. The survey finding that the majority of people in the UK (81% agreed, 6% disagreed and 13% didn't know) think there should be a global regulatory framework for genetic technologies could be useful evidence to inform future discussions.

The genetic technologies research community:

This research is also expected to help inform the research community about which applications are the most controversial from a public perspective and make recommendations about how organisations and researchers can engage the public on genetic technologies, and how they can ensure applications are ethical. There was wide agreement with the sentiment that "*This is a useful contribution to a growing body of work which furthers understanding of what people are thinking and what underlies it*".

Contact Group members from research institutes indicated that the findings from this research will have different levels of direct impact on their research, depending on their own dialogue processes. All those interviewed have their own public engagement programmes and the BBSRC is keen to see them using public dialogue methodologies to help shape their research agendas and priorities. Of those interviewed only the Francis Crick Institute, the John Innes Centre and the Sainsbury's Laboratory Cambridge University have yet had the resources to do so. These organisations expect to use the findings from the study as inputs to their engagement materials and events (e.g. as part of Crick's "Medicine" programme aimed at staff, post docs, students and medical students, and journalists) but do not see the research directly shaping their research priorities.

Others such as the Roslin Institute and the University of Edinburgh have not yet undertaken their own dialogue processes and report that the study is useful as proof of the dialogue concept. Most of the specialists involved in the dialogues had appreciated seeing people's confidence build as they were given the space to discuss and that public engagement is no longer about educating people into changing their minds. The findings may be directly useful in shaping priorities, as one interviewee reported "*Our funders are always pressing us to do public dialogue but it's really very expensive and we don't have the budget so this will be useful if the Royal Society makes it publicly available*". They also imagine using the dialogue materials and other materials produced by the Royal Society on their websites and in their public engagement programmes.

[2] Royal Society evidence to HC Science and Technology Committee, May 2017

Research Community's views about potential impacts for their institutes

- *"A great thing to have been a part of".*
- *"Public dialogue is really expensive, but moving in that direction with our public engagement – useful to see that it's not just about getting the information out there but also giving people confidence that their opinions are useful".*
- *"I was delighted that Royal Society was doing this because we don't have the budget"*
- *The qualitative research gave a depth of material which will help to inform my research and how different concepts are applied (e.g. 'naturalness' 'agency' and 'responsibility')".*
- *"The findings resonate … Unlikely we'll use the results to decide our own GM research agenda but this will be very useful evidence in future discussion with policymakers and regulators about genetic technologies".*
- *"It is important for RS to be open and active in public engagement in these areas – not to be seen as in an ivory tower – and so this was a very good thing – it is part of RS moving towards engaging with the public on a level playing field – less about experts and lay people – more about a porous discussion on what matters to people, societal issues and developing solutions to problems"*
- *"Do not see any immediate uses for the findings and outcomes. [We] do our own public engagement so this work will not influence our research priorities – but keen to now see Royal Society moving to the next step which is not technology-based but application-led and with more differentiation between plant, animal and human medical".*
- *"We don't have our own public dialogue programme but do a lot of public engagement and ongoing conversations with the public – a useful first step for Royal Society but not yet telling us anything brand new."*
- *"Enjoyed meeting people involved and the conversations were interesting – but I didn't learn anything completely new that other research over the last 10 years hasn't already told us".*

Lessons:

- Although there was no specific policy question posed by the dialogues, the results are timely in helping inform current and upcoming policy and regulation discussions at UK, EU and international level. It is too early to quantify what the wider potential impact might be.
- The study provides proof of concept that public engagement around such rapidly developing technologies is better addressed through a 'dialogue' rather than a 'deficit' model.
- The UK and international research communities will find the results and process outputs useful to validate their own research and for their own public engagement activities.
- The research community interviewed saw this research as a good start to an ongoing process: they identified scope for the Royal Society to continue small group discussions, repeat the opinion survey and reframe research, and to continue research strands with a tighter focus.

9. Costs and Benefits

9.1 Costs

Financial costs

The total financial cost of the delivery of the project was £110,000 including VAT to cover the public dialogue, a public opinion poll and an independent evaluation. The delivery contract included public dialogues with a total of 82 participants in Round 1 and 70 participants in Round 2 across three UK locations, who each met twice (estimated 80% of the delivery budget) and a nationally representative opinion survey of more than 2000 individuals (estimated 20% of the delivery budget). The budget covered 6 meetings in 3 locations, recruitment and a small incentive payment to participants (£160) for attending the two days. It also included recording and editing interviews for two Talking Heads videos and a vox pop with participants. It also included the subscription for use of the online survey platform with a small incremental cost (£800) to cover additional questions beyond the 50 originally envisaged. The cost of producing the Royal Society's animated introductory video was not included in the contract. The delivery contract was funded entirely from the Royal Society's genetic technologies programme. A small additional grant was provided by the BBSRC to cover the costs of the independent evaluation, which had not originally been costed into the programme.

Given the wide scope and constrained budget (with effectively three mini dialogues in parallel and a large public opinion survey) this study provided excellent value for money. Comparable studies delivered under the Sciencewise programme might have been expected to cost at least £10-15k more for the same outputs. The contractors managed to deliver all the required elements to a very high standard through a combination of: a small versatile team (without note-takers and with the lead facilitator recording and editing interviews); a close collaborative relationship with the Royal Society core team; using an online survey platform; and using skype to record video calls rather than face to face meetings. The project was delivered on budget but the time required to design a high quality online survey, getting materials/survey signed off without the contractors having a direct line to the Contact Group, and additional interim reporting on emerging findings were not fully covered by the budget.

Contributions in Kind

Contributions in kind were a key factor in the success of the project. The Royal Society core team took the lead in developing technical materials for the dialogue including the animated video on Genetic engineering, the timeline wallchart, the jargon buster and the nine case studies. For each dialogue session at least one member of the core team (and often two) introduced the project and its objectives, gave an overview of the technologies and the case studies, and gave feedback at the end of the day on what the Royal Society had heard and how it would inform their work. The core team also convened the Contact Group and will run dissemination events in March. Between the project manager (who input an estimated 3 days a week over 3 months) and other core team members we estimate that the Royal Society team invested at least 60 days over the project life time. Other contributions in kind are estimated at:

- About 50 days of input from Contact Group members who agreed to attend three face to face meetings, be interviewed by the contractors and/or evaluators, review dialogue materials and survey, and review the final report. Not all Contact Group members managed to attend all meetings but many took the opportunity to be briefed by the core team when they were unable

to attend. The Chair and four others took part in at least one dialogue session as a specialist panellist and about 6 members have given considerable time to materials/survey development.
- About 6 days invested by specialists from other institutes who took part in the half day or full day dialogue sessions.

A very rough valuation of in-kind inputs, based on an opportunity cost of £500/person day, implies an additional investment of about £58,000 equivalent to 50% over and above the financial budget. All those interviewed as part of the evaluation felt that their time had been used efficiently and inputs were commensurate with the benefits that they expected the project to deliver. The only area where time inputs exceeded expectations was the design of the online survey.

9.2 Benefits

Within the timeframe of the evaluation - before the publication of the report or the Contact Group decision about how to use the findings - it has not been possible to quantify impacts and therefore to estimate economic benefits. The fact that the research has been broad in scope and not focused on informing very specific policy outcomes would anyway make this difficult. However, it is clear that if this research and any subsequent follow up in the human health or regulatory areas feeds into the growing evidence base and debate around future regulations and commercialisation of genetic technologies, the benefits for the UK economy could be considerable.

For instance, no GM animals have been approved for human consumption in the EU, and only a few varieties of commercial crops (mostly maize) have been approved for cultivation. However, if the results of the research help inform a relaxation of regulation of minor CRISPR/Cas9 edits to plants and animals for food, the economic opportunities for UK genetic technologies research community and food industry could be considerable.

In the human domain, the UK Government has identified genomics (mapping and editing of genomes), and biomedical sciences more broadly, as a major growth opportunity for the UK economy. The public dialogues and survey show evidence of optimism and support for use of genome editing and genetic therapies to avoid early deaths, heritable life-threatening conditions and manage chronic conditions, particularly where they might save the NHS money. A recent study estimated that the UK commercial market surrounding human genomics sequencing alone[3] at £0.8 billion. The market for GM medicines, vaccines and therapies could be much larger. However, there are concerns that current uncertainties surrounding the existing rules on genome editing are making research using CRISPR/Cas9 too costly and risky for small start-ups and may stifle innovation. Future changes to regulations that clarify or amend regulations could therefore bring both market development opportunities and public service cost savings in the longer term.

Lessons:
- A versatile small delivery team, close collaborative working with the core team, and use of a low cost survey platform allowed this ambitious project to be delivered to a high standard, within a tight budget and challenging deadline. This required some cost-cutting compromises (e.g. restricting the scope to one research domain per location, using skype for interviews) but without serious impacts on the quality.
- The tight deadline between the final dialogue sessions and launching the survey contributed to making the process more onerous than expected. A drafting workshop with a smaller group of Contact Group members might also have helped streamline the process.

[3] Deloitte Monitor, 2015, Genomics in the UK: An industry study for the Office of Life Sciences, BIS

- This research may contribute to the landscape of evidence which could help inform regulatory review with significant potential benefits for the UK economy. It is too early to identify those benefits and attribution to this strand of the Royal Society's work may not be possible.
- Further value could be added at relatively low marginal cost by re-contacting a small group of dialogue participants as a citizen's panel or sounding board and by repeating the online public opinion survey at regular intervals (two to three years).

10. Credibility

This section evaluates whether the dialogue process has been credible and robust based on feed-back from participants and specialists who took part in the dialogues and other members of the scientific community represented on the Contact Group.

10.1 Scientists and Policymakers

The overall approach of mixing a medium-sized public dialogue component with a nationally representative public opinion poll was tried and tested but included some innovative elements. The decision about the scale, mix of methods and sequencing of research was informed by prior experience of the Royal Society and Contact Group members including work on Machine Learning (Royal Society, 2012)[4] , John Innes Centre (JIC, BBSCR and Sciencewise, 2016)[5] to help frame its next five year research programme and bid for grant, and a policy-led study on Mitochondrial Replacement regulations for the Human Fertilisation and Embryology Authority (HFEA, 2013)[6]. Each of these projects involved quantitative opinion surveys (ranging from 500 to 1000 nationally representative members of the public) and reconvened public dialogue workshops in several locations (30 to 90 members in the public). Two also included separate focus groups with smaller groups identified as likely to have strong opinions about genetic technologies (patient groups and religious groups).

The Royal Society's budget did not allow for separate stakeholder workshops, focus groups; time for each small group to discuss all three research domains; or computer-assisted personal interviewing (CAPI) for the quantitative survey. Any potential risks to credibility of the methodology were addressed by:

- A large online sample size (2000) compared to previous surveys so that a wide range of demographic and socio-economic characteristics - including religious affiliations – could be covered with 95% confidence levels. Disaggregation of survey results by religion and age, showed limited difference from the findings for the overall sample.
- Deliberately including those likely to have strong views on genetic technologies in the dialogues. Some Contact Group members worried that this could introduce bias, polarise groups or cause disruption. Our observation was that it broadened the range of views expressed and added value to the discussions.
- Contingency for one-to-one telephone calls to fill under-represented cohorts for the online survey (such as older people) if necessary. In the event all cohorts responded rapidly on line (including over 80 year olds and even one 98 year old) and no individual calls were necessary.
- Using the learning from the dialogues about what language would be accessible to the public. Terms such as cisgenic and transgenic were avoided. Most respondents seemed to have sufficient background information to answer all questions. A small minority seemed to struggle with the technical questions (an average of 10%, 11% and 12% answered "I don't know" to the questions about human, animal and plant domains respectively compared to only 3% for general

[4] 978 face-to-face interviews with a representative public in-home, using computer-assisted personal interviewing (CAPI) on Ipsos MORI's weekly omnibus survey with final data weighted to ensure the individuals selected for interview were representative of the national population. This was followed up by qualitative research, which involved two weekend-long dialogue events in Birmingham and London, along with two evening focus groups in Oxford and Huddersfield.

[5] The dialogue comprised day-and-a-half-long workshops in Norwich and Birmingham over a 2 month period with 32 members of the public and an online community of 446 participants.

[6] A Sciencewise co-funded dialogue involving three two day workshops in three locations with 25 participants each and a face-to-face public opinion survey with just under 1000 people. The study also included an online forum and focus groups with target audiences of potentially strongly opposed (religious groups) or strongly supportive (patients groups). A strong correlation was found between negative responses and religious affiliations.

background questions). It is not clear whether this reflected problems with the wording, the concepts or forming an opinion with limited background information.

All of the Contact Group members interviewed were happy that the study methodology was credible and had produced robust results that could be treated with confidence by their institutes, the Royal Society, industry and government.

Most of the research scientists felt that the combined findings from the qualitative and quantitative methods may not have produced surprising results but will add to the growing body of evidence *"the quantitative results are interesting as a barometer of public opinion"* and that they *"seem to show a shift in public opinion with more people tending to be for than against".* This resonates with findings from their own engagement activities. Most also agreed that findings are more granular than those of previous studies and show a growing sophistication amongst the public in distinguishing between types of applications (more positive for human and health related applications and less for cosmetic enhancements of humans, animals or plants). Given more time to design the online survey one interviewee suggested it would have been useful to test out the "order effects" of cold framing of some questions in the survey (e.g. around regulation and commercialisation which were included in groups of questions about each specific domain) and testing whether the results would be different if the questions were grouped together.

Policymakers and specialist views on methodology:

- *"The proposed methodology was perfectly suitable and the contractors understood the framing and were able to involve experts in an appropriate way".*
- *"Very useful to have the qualitative research for people to pick up the breadth of issues and then build a usefully large survey to test the findings".*
- *"Good to have both qualitative and quantitative results to provide depth and prevalence or representativeness of opinions expressed".*
- *"The mix of qualitative and quantitative was important since the dialogues gave very rich information – it would be interesting to explore ways of achieving larger samples [for the dialogues] using social media. But the combination with the online survey gives enough weight for the results to be used with confidence".*
- *"Perceived independence of delivery is very important and ensuring that the information provided is robust and balanced. Including an independent evaluation was an important aspect of ensuring credibility".*
- *"With three times the budget we might have looked at all three topic areas in each dialogue location but maybe it wouldn't have added that much".*
- *"The length of the engagement over an extended time period – not just one point but the sense of a journey – [was] a really valuable part of this process".*
- *"How you phrase and sequence the questions in terms of the answers you then get e.g. commercialisation and regulation questions asked sequentially in relation to each thematic area probably give different results than if you ask them in relation to all three thematic areas together".*

10.2 Participants

Almost all participants found the dialogue process important and necessary. No one interviewed had been part of a deliberative dialogue before but almost responding to the question after Round 2 felt it was important to consult the public on these issues (82%, 56 strongly agreed, 15%, 10 tended to agreed). Many were passionate about the need for the public to be involved, one noting that "*the issues affect society as a whole; important everyone has a voice*" and others calling the dialogue process "*imperative*", "*crucial*" and "*vital*". There was also a sense that, having been offered the opportunity to participate, "*it's my public duty - I never thought about not coming back for the 2nd day*". Only two participants did not fully agree. One stressed that dialogues are important "*but only as an input into the wider debate*" while the other pointed out that "*the public are not experts and*

cannot be expected to weigh up the volume of information to make a balanced and correct decision". Many of those taking part highlighted a need to fill the gaps in the wider public's knowledge about genetic technologies to allow many more people to play a part in decision-making. Greater transparency of information about who is doing what and including genetic technology in the curriculum were highlighted as ways to address this.

Most participants believed that their inputs to the process would be put to good use. Of the 68 respondents at the end of Round 2, 94% were confident (43%, 29 strongly agreed, 51%, 35 tended to agree) that the findings will help inform how scientists and policymakers decide the direction of future genetic technology research and applications. Only a few were not fully convinced. One was "*sceptical but can't wait to see outcomes*" while another "*would have liked to have been more positive but I remain to be convinced*". The vast majority were optimistic and a typical view was "*I hope they give considerable weight to the information gathered*". In comparison to many government-led dialogues this level of trust is high and resonates with the findings of the trust ranking exercises in Round 2 where academic researchers and professional organisations were seen as amongst the most trusted to develop and inform on genetic technologies (others include charities, trusts and foundations, and regulatory bodies). Informal interviews during the dialogues suggest that participant's belief in the process reflects the openness of discussions they were able to have with the genetic scientists and ethicists in the room *("[they] will be pro-GM but they seem to be balanced in their views, not trying to influence us in one particular direction*", the belief that the materials presented were balanced and unbiased, and the time and effort they could see the Royal Society had invested in the process ("*It was good to see [Royal Society] observers as part of the process*").

The confidence that participants held in the process was also evidenced by the fact that, although they were not asked specifically, about 15% took the trouble to let the evaluators know that they had found the process and topic so interesting that they would be keen to continue being involved commenting that "*I really enjoyed the 2 sessions and would love to take part in the future"* and that the process was *"very engaging and informative, [I] would be willing to contribute going forwards".*

Lessons:

- The mix and numbers of qualitative (82 participants in Round 1 and 70 in Round 2) and quantitative (2061 respondents) methods and design details resulted in a credible methodology within the available budget. The results are considered convincing by Contact Group members, providing a useful barometer of the public's views on genetic technologies across a very broad range of applications and a more granular understanding of views about commercialisation and regulation than previous studies.
- Participants were almost all enthusiastic about their involvement in genetic technology decision-making. Almost all were confident that their inputs will help inform future decisions on genetic technology research and applications. High levels of confidence reflected on the investment they saw the Royal Society had made in the process, the perceived balance of information they received and the openness of discussions with scientists and ethicists in the room.
- The small group of individuals who expressed an interest in continuing to be involved could usefully provide the Royal Society with a small panel or sounding board for testing communications messages, piloting surveys or helping shape future research topics.
- To increase its value as a barometer the quantitative survey could be repeated at regular intervals, at which time it might also be useful to test the framing/grouping of some questions (e.g. around regulation and commercialisation).

11. Summary of Key Findings and Lessons

11.1 Conclusions

A versatile small delivery team, close collaborative working with the core team, and application of a low cost survey platform allowed this ambitious public dialogue and opinion survey project to be delivered to a very high standard, within a modest budget and a challenging five month deadline. The sequencing and mix of qualitative dialogue (70 participants) and quantitative opinion survey (2061 respondents) met three out of four objectives of the research very well providing both a depth and a breadth of understanding of how people view a range of potential applications, the context and caveats around their use, and their trust in different actors to work on, inform about and regulate genetic technologies. The very wide scope of the study – covering human, animal and plant applications – made the framing challenging and may have over-emphasised genetic technologies as the solution, rather than a potential solution to global challenges, making it difficult to fully meet the fourth objective.

All participants and specialists reported high levels of satisfaction with the dialogue process. Rapid response rates, and fully completed and considered responses also suggest high satisfaction with the online survey.

Although the research did not pose any specific policy question, the results are timely in adding to the evidence landscape which will help inform current and upcoming policy discussions about how genome editing using CRISPR/Cas9 should be regulated at UK, EU and international level.

11.2 Lessons Learnt

Lessons learnt from the design and delivery of the dialogues included:

- The study benefitted from the Contact Group and core team's experience of running similar studies, and the hands on involvement of a smaller group (about 6) Contact Group members in reviewing materials and attending the dialogue as specialist panellists.
- The decision to focus on one research domain in each location, but with a common structure across all three locations, gave the dialogues a manageable focus while still allowing cross-comparisons across themes.
- Recruiting 10% of the sample with a prior interest in genetic technologies ensured the full breadth of views were heard in the room. Skilled facilitation ensured it did not disrupt others.
- A good mix of techniques (single, pairs, small group and plenary activities) and activities (discussion, role play, posters, carousels) meant that everyone participated actively and all felt they had made valuable contribution. The variety of techniques for capturing participant's views (written, recorded and vox pops) generated rich outputs with a very cost effective facilitator: participant ratio (up to 1:10).
- Scheduling sessions three weeks apart (including a full day meeting on a Friday in London) worked well with acceptable attrition rates. A homework task maintained momentum and helped participants consolidate their thoughts by talking to friends and family. The break also gave space for those who wanted to do their own research.
- Co-production of materials between the Royal Society (responsible for technical content with support from the Contact Group) and the contractors (responsible for making them appealing and accessible) allowed technically accurate and balanced materials to be produced within a challenging timeframe. But without a direct contact line between the contractors and Contact

Group this took more time and iterations than needed. A more compact drafting group could have streamlined the process and perhaps also allowed involvement of NGOs.

- The experienced and warm facilitation style, and team continuity across events resulted in very positive group dynamics. Sensitive handling of individuals with special needs or who might have dominated meant that participants all felt they had found their voice and been heard.
- A good mix of scientists and social scientists at each dialogue workshop helped participants get their questions answered and build confidence in their own opinions. The structured plenary Q+A sessions surfaced the big questions and avoided duplication. Specialists' final reflections on what they had learnt and how they would use it, fostered high levels of confidence in the process and belief that findings would inform future research choices.

The following lessons were learnt from the online survey:

- The use of a cost-effective online platform allowed a large nationally representative survey to be achieved quickly. The findings added value to the dialogues by providing breadth, direct cross-comparisons across domains and more granular understanding of attitudes to commercialisation and regulation.
- Both the Royal Society and contractors under-estimated the time needed (elapsed and person days) to analyse the findings from the dialogues, to gather inputs from the Contact Group and to craft a survey that could meet the framing, ordering, language and supporting information needs of a survey of this type.

11.2 Recommendations

- Contact Group members generally agreed that the research has been a good start in what they would like to see as an ongoing process. The dialogue research could be taken forward at relatively low cost by re-engaging the small group of keen participants (subject to data protection requirements) who expressed an interest in continuing to be involved. The online survey could become a useful barometer of evolving public opinion by being repeated at regular intervals (two or three years).
- Future research may benefit from a narrower scope (e.g. on human health issues) allowing a framing from the point of view of global challenges to which genetic technologies could be a part of the solution. More research on views on commercialisation and regulation would also be useful as UK and international policy choices become clearer.
- Similar research projects could usefully build in: more direct lines of reporting between the contractors and the Contact Group (e.g. through a smaller drafting group); more involvement of NGOs in dialogue processes; and longer lead times for analysing the findings of qualitative research.

Annex 1: Members of the Contact Group overseeing the public dialogue and Core project team

Name	Organisation	Area of expertise
Professor Robin Lovell-Badge FRS*	The Crick Institute	Chair contact group/ Humans (germline)
Professor Dame Kay Davies FRS	Oxford University	Humans (somatic)
Professor Dame Ottoline Leyser FRS*	Cambridge University	Plants
Professor Dale Sanders FRS*	John Innes Centre	Plants
Professor Helen Sang*	Roslin Institute	Animals
Professor Bill Adams	Cambridge University	Animals (ecology)
Professor Austin Burt	Imperial College	Technique (gene drive)
Professor Paul Freemont*	Imperial College	Technique (synthetic biology)
Professor Roderick Flower FRS	Queen Mary's	Biosecurity
Dr Mark Bale	Department of Health	Policy/ regulation
Professor Guy Poppy	Food Standards Agency	Policy/ regulation
Dr Dietram Scheufele	University of Wisconsin-Madison	Public engagement
Dr Sarah Chan*	University of Edinburgh	Ethics
Judith Batchelar	Sainsbury's	Industry
Sir John Skehel FRS	Royal Society observer	Humans
Dr Patrick Middleton*	BBSRC	Strategic stakeholder
Member of Royal Society Core Team		
Emma Woods	Head of Policy, Wellbeing	
Jonny Hazell*	Senior Policy Adviser, Genetic Technologies programme	
Tracey Hughes*	Head of Marketing and Public Engagement	

*Interviewed for the evaluation

Annex 2: Summary of evaluation feedback from Public Dialogues Round 1 and 2

Summary of Evaluation feedback R

Summary of Evaluation feedback R