Public Dialogue on Future Strategy for the Babraham Institute

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Contents

Executive summary

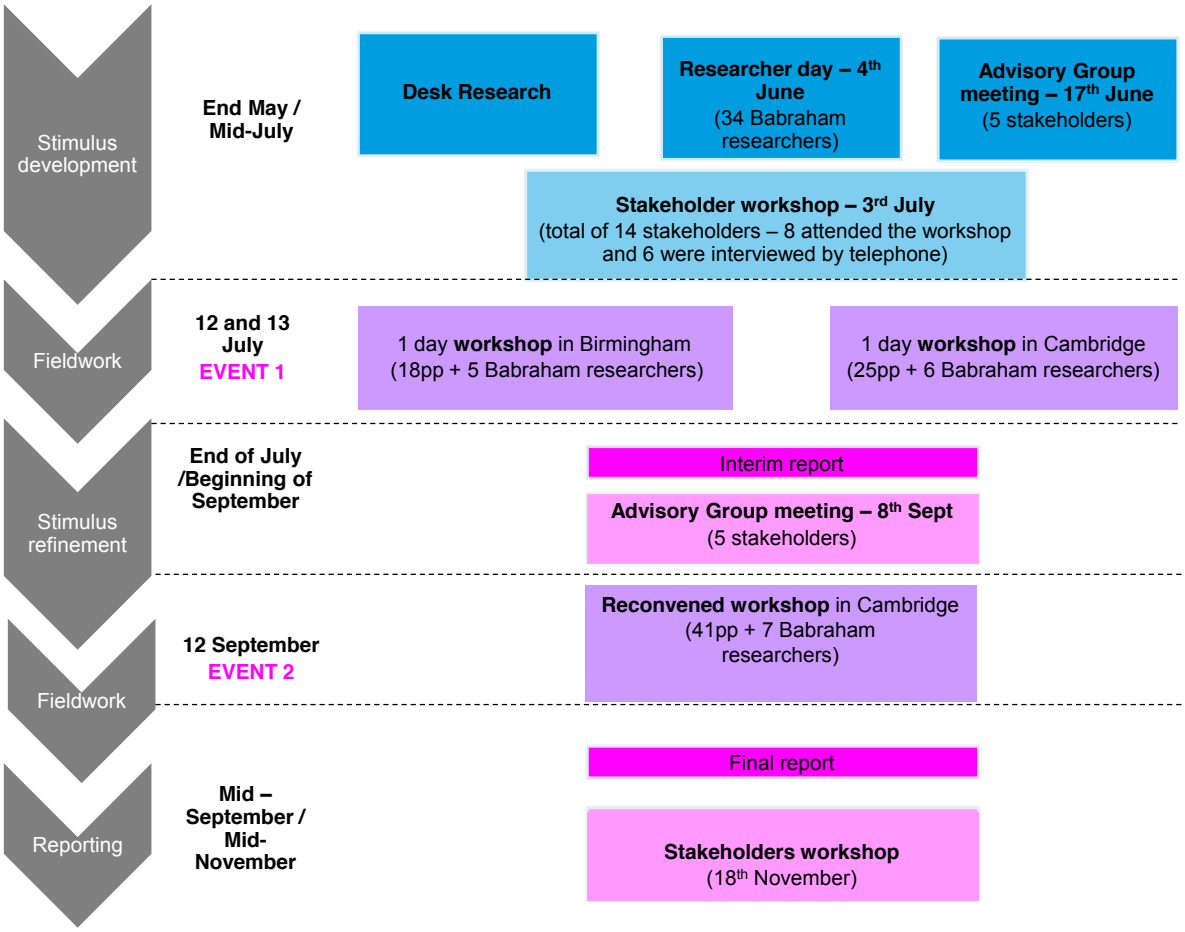
This report presents the findings from a public dialogue process commissioned by the Babraham Institute and the Biotechnology and Biological Science Research Council (BBSRC) , with support from Sciencewise[1].

1. Introduction (objectives and project design)

The aim of the project was to carry out a public dialogue to feed into the Babraham Institute's science and public engagement strategy 2017-22. Key objectives for this dialogue were:

1. To engage in dialogue with civil society and other stakeholders and a balanced recruited sample of lay public about the challenges and big questions relevant to the Babraham Institute.
2. To gain insight and understanding from the public and civil society that will inform and influence both scientific (2a) and public engagement (2b) strategies.
3. To raise awareness and highlight the importance of the Institute and its science with stakeholders.
4. To gain an understanding of how the public and stakeholders view Babraham Institute's work.
5. To demonstrate best practice in openness/responsiveness and social responsibility.

To meet Objective 1. a dialogue was conducted including the following activities and events. This process followed Sciencewise's guiding principles[2].



[1] Sciencewise is funded by the Department for Business, Innovation and Skills (BIS). Sciencewise aims to improve policy making involving science and technology across Government by increasing the effectiveness with which public dialogue is used, and encouraging its wider use where appropriate. www.sciencewise-erc.org.uk

[2] http://www.sciencewise-erc.org.uk/cms/guiding-principles/

2. Public views

This section summarises the views of the participants in this public dialogue project. These views have been taken from observations and careful analysis of events, post-event evaluation and from analysis of a homework exercise.

2.1. Overall views of science (meeting objectives 3 and 4)

- Most participants started from a low awareness of scientific research, and especially basic research. However by the end of the dialogue, most participants wanted to protect and support the function of fundamental bioscience research.

2.2. Views on ageing (meeting objectives 1, 2 and 3)

The Institute's research sits within BBSRC's Healthy Ageing research strand. Participants were asked to discuss what ageing meant to them, as a start point for investigating their views on bioscience in this area.

- Participants described ageing as the factors which affect people in old age, rather than a process that happens through life.
- They believed that physical, mental, and social elements are interconnected and all contribute to ageing.
- Ageing well was considered to be (to some extent) under individual control, based on making good health choices through life.
- Ageing has some positive side effects (like wisdom and appreciation of your body) – so they saw downsides as well as benefits to science which seeks to combat the ageing process.

2.3. Views on the challenges for science (meeting objectives 2a and 5)

- Diseases and illnesses were seen as unfair, unnatural, and a challenge to be beaten by science. Participants preferred the terminology of beating diseases rather than healthy ageing, though they did like the idea of beating age-related diseases, particularly familiar threats like cancer and Alzheimer's.
- The emergent concept of epigenetics was seen as a key frontier for science. This was the idea which most interested participants and sparked imagination across the whole dialogue.

2.4. Implications for Babraham's science strategy (meeting objective 2a and 5)

- Participants wanted Babraham to work to combat inequalities in health outcomes because they felt that illnesses and diseases are inherently unfair in their effects. They wanted this even though they understood that fundamental science is not the same as medical research.
- Focusing on epigenetics was seen as a priority by participants.
- Babraham could consider ageing research in its social context (i.e. not simply as a biological process).

2.5. Implications for Babraham's public engagement strategy (meeting objective 2b)

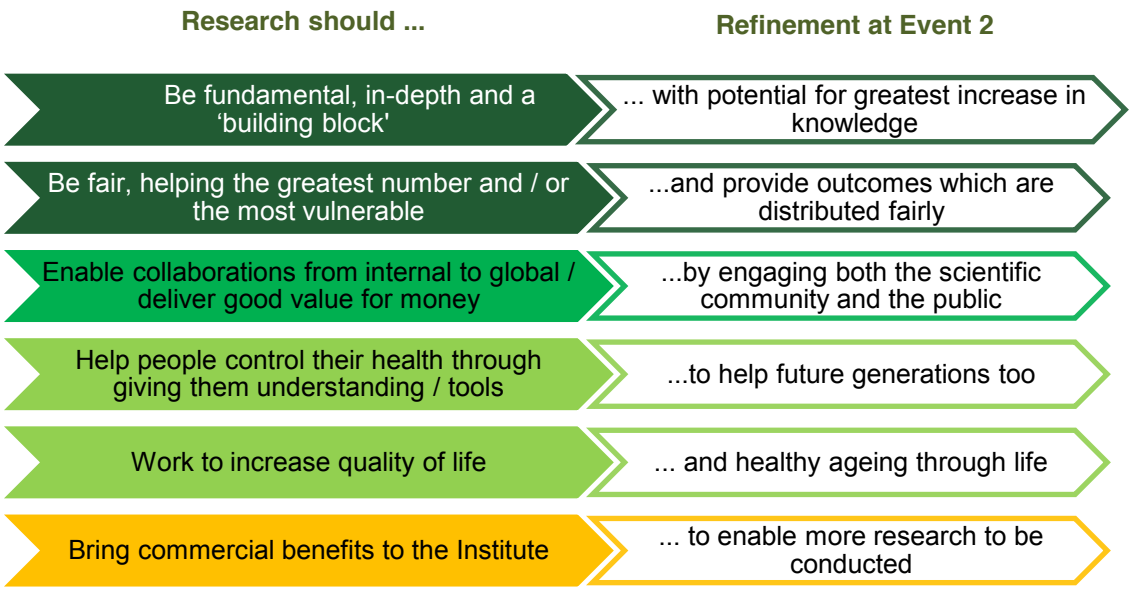
- The following ways of introducing ageing research to the public are most likely to interest them and help them understand the concepts.
    - Consulting the public about delaying illness and increasing resilience, not reversing or stopping ageing.
    - Consulting the public about ageing of people, not of cells; even when the project is at a very early stage or at a molecular scale.
    - Consulting the public about equipping people with the information they need to make good choices and increase their own wellbeing.

3. Views on strategy: public principles for science and governance

3.1. Scientific principles

Participants identified six **scientific principles** which they felt should inform the science strategy at the Babraham Institute. These were first shaped and identified at Event 1 and were nuanced and enhanced after further discussion at Event 2.

3.2. The diagram below summarises them. Green indicates strength of feeling. The final principle (in orange) tended to polarise views and was supported by some and contested by others.



3.3. Principles for governance

Participants identified two key ideas:

- They wanted Babraham to support projects which are in the public interest and which are most likely to deliver on the priorities identified above, when applying for grants.
- If the Institute is committed to accountability, it needs to enable scrutiny to make this commitment credible. This could involve taking account of a number of different voices (academic, media, lay, external experts) to bring a wider discussion of the interests of different stakeholders into strategy-setting.

4. Response to case studies in detail

4.1. Reactions to case studies

Participants' knowledge of bioscientific concepts was too limited for them to give strategic perspectives about the work of the Institute on the level of the **Institute Strategic Programmes** (ISPs; Epigenetics, Signalling, Immunology and Nuclear Dynamics).

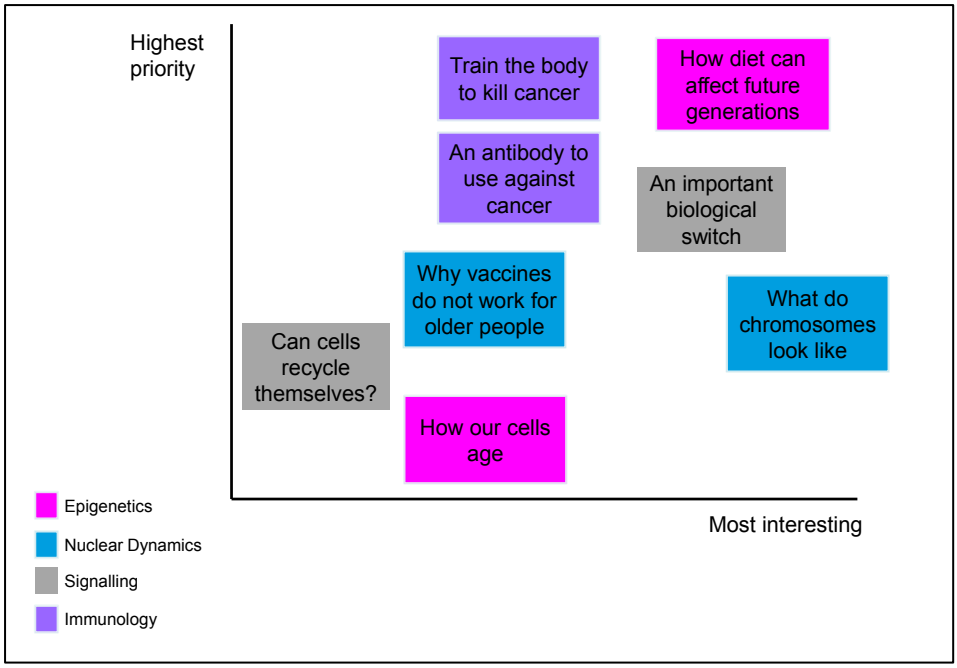
Participants were shown eight case studies, two from each Institute Strategic Programmes (ISP). Participants used these detailed examples to draw out the principles they felt were important. At the analysis stage, two dimensions emerged as important and we have plotted them in the chart overleaf. The case studies were essentially seen in terms of the ***highest priority*** and the ***most interesting*** types of work.

- **Highest priority types of work**: Case studies on **how diet can affect future generations** and **how to train the body to kill cancer** were seen as high priority. The Institute's work on **an antibody to use against** cancer **(Vectibix)**[3] was also seen as high priority for those who felt that an important aim would be to increase revenue through marketing intellectual property. The case study on **an important biological switch (PI3Kinase)**[4] was also relatively high priority because it was seen as a fundamental, 'building block' study.

[3] Vectibix is a drug used to treat colorectal cancer. It is created using specially bred mice, licensed by Babraham Institute, to create 'humanised' monoclonal antibodies, which are not rejected by the human immune system

[4] The PI3K (PI3 Kinase) family is a family of eight proteins which have been found to be very important in fundamental cell processes such as growth, proliferation, division and survival/death. There are multiple PI3Ks, but each acts as a 'switch', starting the same fundamental chain of events (a cell signalling pathway) which ends in protein transcription

- **Most interesting:** Participants often focused on the practical detail of the project, rather than the conceptual science. Hence, the projects they found easiest to understand were often seen as most interesting. This illustrates the need to communicate clearly to allow the science itself to be understood. **How diet can affect future generations** included a human-level story which made it interesting. **What do chromosomes look like** appealed because of the visual aspects of the case study.



5. Openness and transparency around animal research

5.1. Animal research and the commitment to openness

Babraham has committed to openness and transparency in its animal research. The dialogue explored how participants thought these principles of openness and transparency could best be applied to the work done at the Institute (mostly with mice). This helped meet the objectives of raising awareness (objective 3) and demonstrating best practice in openness (objective 5), as well as gaining insight for strategy (objective 2).

5.2. Public views

- Most understood why Babraham was making a commitment to openness and transparency. They felt that this would help address any negative feedback proactively.
- Overall, participants felt animal research was necessary to advance science and was acceptable when carried out ethically and when well regulated.
- The main driver of trust was that participants believed the scientists who were there on the day; they personally assured participants that they cared about the animals, considered ethical issues, and adhered to the '3Rs'.[5]
- In order to be reassured, some requested more information about:
    - The level of suffering experienced.
    - Why mice are good models for human biology.
    - The numbers of mice really needed.
    - Why animals have to be killed at the end of a project.
    - What is involved in breeding transgenic mice.

[5] http://www.understandinganimalresearch.org.uk/files/1214/1041/0135/appendicies-to-openn.pdf
The 3Rs are: **replace** the use of animals with alternative techniques, or avoid the use of animals altogether; **refine** the way experiments are carried out and the way animals are housed and cared for throughout the animal's experience, to make sure that suffering is minimised and animal welfare is improved; **reduce** the number of animals used to the minimum necessary, so that the scientific question can be answered robustly, but using fewer animals or more information obtained from the same number of animals.

5.3. Implications for Babraham are largely around communication, within the public engagement strategy (objective 2b); effective communication of animal research would involve answering the reassurance questions above.

6. Public engagement

6.1. What is public engagement?

Public engagement can be divided into **communication**, **consultation** and **participation.** This dialogue illustrates how the Babraham Institute could best carry out engagement in all three areas.

6.2. Communication

Levels of knowledge about bioscience and the Institute's work were very low. Key areas to communicate to the public are:

- Who scientists are and what they do all day.
- The scientific approach and process.
- Sharing cutting-edge science as it happens.

Dialogue participants asked for fun, informal communications approaches. Babraham needs to be aware of the challenge in getting the public involved in questions of bioscience and giving them enough information, while at the same time communicating in a simple and interesting way.

6.3. Consultation

Researchers and participants had reservations about how far the public could meaningfully be consulted on very detailed issues of science. Nevertheless participants felt they should be able to feed back their views to scientists, in the context of a two-way conversation where both sides could question the other and reveal their perspectives. Relevant subjects would be: ethical debates; or the implications of research findings.

For best results, the problems would be couched in terms of human effects rather than in the language of molecular bioscience. Appropriate channels were felt to be Q&As, interactive exhibitions and online forums.

6.4. Participation

Participants saw some opportunities for a deeper 'collaboration' with the Babraham Institute. They felt the public could be engaged with some specific areas of work and might become informed enough to join strategic discussions, for example on ethics, epigenetics, and disease-driven vs fundamental research directions; and that these were subjects where lay opinions would be valuable and should drive strategy.

They felt it was incumbent on a publicly-funded Institute to allow the taxpayer some say in decisions on how funds are spent. The public felt it was important for the credibility of public engagement that scientists should be as involved in these engagements as possible.

7. Considerations for the future

The report concludes with some questions and reflections for future consideration by the Babraham Institute management team.

- How could future engagement be shaped, in the light of knowledge from this dialogue about the lay public's views of ageing, low levels of knowledge of bioscience, and interest in personal and human-level narratives?
- The findings suggest that there are some clear public priorities for science strategy. How can the Institute take account of these in its decision making?
- The findings of this dialogue suggest it would be of interest to the public if the Institute committed to 'public collaboration' as well as 'engagement'. How could public 'collaboration' be achieved within the Institute?
- How can awareness-raising and two-way engagement be continued, and what resource-effective ways are there to do it?
- The value of the dialogue is ultimately in its impact on internal practice. Which mechanisms within the Institute can link public and stakeholder views back to research and engagement strategy?

1. Introduction

This report presents findings from a public dialogue on the future strategy of the Babraham Institute, commissioned by Sciencewise[6], the Biotechnology and Biological Science Research Council (BBSRC) and the Babraham Institute.

What this chapter contains

This chapter presents the research's objectives and methodology and discusses who the different audiences were and how each was involved.

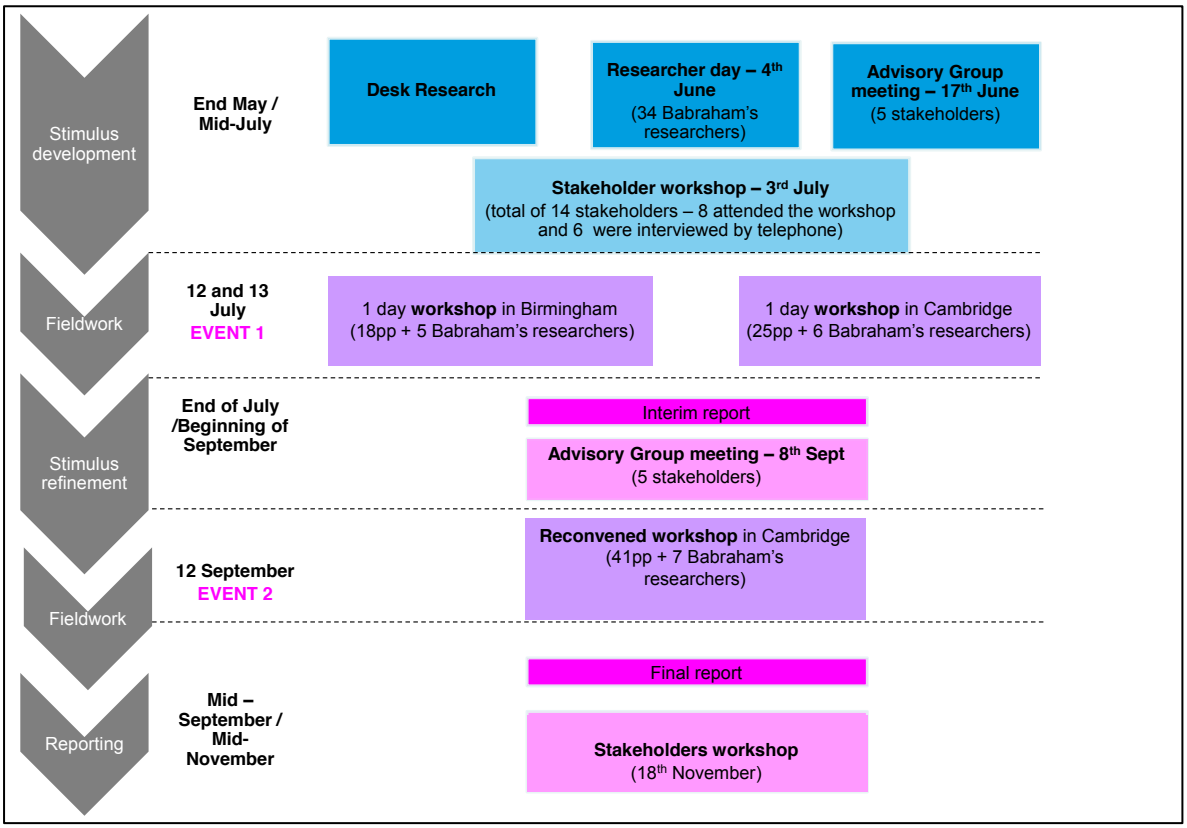
1.1. Objectives

The aim of the project was to carry out a public dialogue to feed into the Babraham Institute's science and public engagement strategy 2017-22. Key objectives for this project were:

1. To engage in dialogue with civil society and other stakeholders and a balanced recruited sample of lay public about the challenges and big questions relevant to the Babraham Institute.
2. To gain insight and understanding from the public and civil society that will inform and influence both scientific (2a) and public engagement (2b) strategies.
3. To raise awareness and highlight the importance of the Institute and its science with stakeholders.
4. To gain an understanding of how the public and stakeholders view Babraham Institute's work.
5. To demonstrate best practice in openness/responsiveness and social responsibility.

1.2. Project design

To meet Objective 1, a dialogue took place in 2015. This process followed Sciencewise's guiding principles[7]. The table below sets out the different activities and events that formed part of the dialogue and the sections below this explain how each element was conducted.



[6] Sciencewise is funded by the Department for Business, Innovation and Skills (BIS). Sciencewise aims to improve policy making involving science and technology across Government by increasing the effectiveness with which public dialogue is used, and encouraging its wider use where appropriate. www.sciencewise-erc.org.uk

[7] http://www.sciencewise-erc.org.uk/cms/guiding-principles/

1.3. How were members of the public involved in the process?

The core of the dialogue was **three day-long events**. The first two followed the same pattern and were called Event 1, held in Birmingham and in Cambridge in July 2015. Across the two locations, forty-three members of the public attended. All these participants were then invited back to a reconvened day-long event (Event 2, held in Cambridge in September 2015).

Participants were recruited using a 'purposive sample'; recruited by quota to reflect spread of ages, gender, life stages and sociodemographic segments of Birmingham and Cambridge respectively. All those who attended the first Events were invited to the reconvened event, and all except two participants attended.

The participants were **recruited on the street** by Ipsos MORI recruiters. Recruiters used a screener which ensured a variety of demographic groups were represented, and that those with a close connection to the subject matter of the Babraham Institute were excluded, as well as any people who were active members of anti-animal research groups. Participants voluntarily joined the process, time-consuming as it was; and they were incentivised with a thank-you gift of money for giving up their time and to cover their expenses.

1.4. Which stakeholders had a part in the development of the dialogue?

The dialogue process was iterative and involved working with a number of internal and external stakeholders.

Audience	Numbers	Details and Purpose
Public Dialogue project team	Fifteen people working for Babraham, BBSRC and Sciencewise were part of the project team See table 1 in appendix A.	Ipsos MORI and the Babraham Institute project team held regular meetings to manage the project day-to-day, look at the core materials and documents and sign off deliverables at key milestones.
Babraham Institute researchers	Thirty-four Babraham Institute researchers from across the Institute. See table 2 in appendix A.	At the start of the project, Ipsos MORI ran three ninety minute sessions at Babraham (the Researcher Day). These sessions enabled Babraham Institute researchers to engage with the study, understand its purpose and provide detailed information about their work, as well as telling us the areas around science and public engagement strategy they wanted the public's views upon.
Babraham Institute Advisory Group	Babraham Institute convened a group of eight key stakeholders - including funders and key partners. See table 3 in appendix A.	The Advisory Group commented on the proposed approach including the reporting and dissemination strategy. They suggested candidates for the external stakeholder meeting. The Advisory Group also commented on draft stimulus for the public dialogue events (Event 1 and Event 2) and heard and commented on interim findings after Event 1. They liaised directly with the project team through face-to-face meetings and also by email and telephone calls.
External stakeholders with an interest and expertise in the area of fundamental science and ageing research	Ipsos MORI ran a half day workshop with eight stakeholders. The views of six additional stakeholders were taken over the telephone, as they were unable to attend the workshop. See table 4 in appendix A.	They represented organisations from sectors that are likely to have an interest in Babraham Institute's work. The external stakeholders commented on draft stimulus in advance of the Event 1. The stakeholders involved represented different views and interests when it comes to fundamental science and the science of ageing.

1.5. How were the events structured and who was present?

In the dialogue events, participants worked in breakout groups and plenary sessions, structured by **discussion guides** (appended). Each section of each day and each discussion in each sub-group provided a different facet of the overall dialogue.

Event 1 was designed to inform participants about the nature of Babraham Institute's work and begin discussion and debate around key issues facing the bioscience community today. In particular:

- public principles and values when it comes to fundamental bioscience;
- priorities around approaches to ageing research; and
- moral and social conundrums which the public feel impact on research in these areas.

The key question for **Event 1** was: **"How can BI's fundamental bioscience help people lead long and healthy lives?"** To engage participants with Babraham's work, a selection of **case studies** covering examples of projects across its four strategic programmes were presented[8]; as well as some limited information about the basic molecular and cellular processes underlying ageing and disease.

The stimuli for these sections were produced with input from the Babraham Institute project team, external stakeholders and Advisory Group. The Ipsos MORI team worked together with specialist science writers[9] ensuring language used in all stimuli was as accessible as possible to the general public, with iterations made based on comments from the Babraham researchers working in the relevant areas, to ensure the case studies remained scientifically accurate.

At the end of **Event 1**, participants were set a **'Homework task'** to complete[10]. This not only maintained involvement in the time before the reconvened Event, but also encouraged participants to spend time reflecting on the issues. The task included:

- exploring the Babraham Institute's 'Immune Army' microsite[11] designed for public engagement events;
- researching 'how science can help ageing' online; and
- interviewing a friend about their experience of ageing.

The day-long reconvened **Event 2** discussed case studies again but related the work to over-arching issues relevant to basic bioscience. In particular:

- the experiences of a scientist, including motivation, career path, funding structures;
- principles drawn out from responses to the case studies, that Babraham Institute should consider in its science strategy;
- the funding of basic bioscience research;
- Babraham's use of animals in research; and
- different aspects of public involvement, discussing ideas for different types of engagement from informing the public about Babraham's work through to co-developing strategy.

1.6. How were Babraham scientists involved at the events?

Attending scientists were briefed by the facilitation team to join in, in an informal fashion, with discussions, while also giving participants time and space to develop their own ideas. Each scientist sat with a particular group of participants, such that across the dialogue different groups had exposure to scientists working in the different strategic programmes. Scientists also had one-to-one conversations with individuals in breaks and lunchtimes. This naturally gave participant groups different perspectives on the issues discussed.

Conversations with the scientists typically started with a more formal introduction to the group where the scientist described their work. Then the scientists became part of the general conversation. Responding to participants' questions, the scientists were able to offer tailored explanations of the more scientific processes

[8] The four ISPs are: epigenetics, immunology, signalling, and nuclear dynamics.
[9] The Refinery, www.refinery.tv
[10] See Appendix E
[11] http://immunearmy.babraham.ac.uk/

discussed in the case studies, as well as offering anecdotes from their own experience. This aided participants in getting to grips with often very complex and specialist issues.

1.7. How to read this report

Interpretation of findings

For reporting on dialogue we use the conventions of qualitative social science reporting, described below in this table.

Qualitative reporting	Value to decision making
Deals with a small sample: in this case we are describing the views of 43 people.	Reflects, rather than represents, the public as a whole.
Gives insights into typical perceptions, thoughts and feelings of people, rather than statistically reliable evidence.	Allows hypotheses about the drivers of beliefs and perceptions, grounded in evidence. Identifies areas which could be investigated further, perhaps quantified, or discussed with wider groups.
Where views apply only to a subset of participants, e.g. participants in Birmingham, we have highlighted this in the text.	Allows identification of differences by region.
We indicate via "a few" or "a limited number" to reflect views which were mentioned infrequently and “many” or “most” when views are more frequently expressed. Any proportions used in our reporting should be considered indicative, rather than exact.	Provides an understanding of the strength of feeling about a point and also a sense of which ideas enjoyed most ‘air time’. Does not give ‘false quantitative’ answers as it avoids counting the statistically not significant) numbers of people who held particular views.

Structure of chapters

An initial introduction sets out **what each chapter contains.**

A text box gives you **key takeaways** and in total these text boxes form the executive summary of the document.

We then describe the findings and implications in detail illustrated by **verbatim quotations** from participants. In brackets there is a reference to where the quote is taken from: ‘Birmingham’ and ‘Cambridge’ for **Event 1**; ‘Reconvened’ for **Event 2**; ‘Homework task’ if the quote is taken from the homework that participants were asked to complete between events; ‘Scientist, Reconvened / Birmingham / Cambridge’, if the quote comes from a scientist; ‘Stakeholder, Advisory Group / Stakeholder Workshop’ if the quote comes from a stakeholder either attending the Advisory Group meeting, or the workshop conducted with external stakeholders.

2. Public views

What this chapter contains

This section summarises views of participants in this public dialogue project. These views have been taken from observations and careful analysis of events, post-event evaluation and from analysis of a homework exercise. In this chapter we note the (relatively limited) contextual knowledge that participants had of **fundamental research**. We then look at what healthy ageing meant to participants, given that the Institute's research sits within BBSRC's Healthy Ageing research strand. We describe the key **challenges** they thought fundamental science should address. We draw out **implications**.

Key takeaways:

2.1. Overall views of science (meeting objectives 3 and 4)

- Most participants started from a low awareness of scientific research, and especially basic research. However by the end of the dialogue, most participants wanted to protect and support the function of fundamental bioscience research.

2.2. Views on ageing (meeting objectives 1, 2 and 3)

The Institute's research sits within BBSRC's Healthy Ageing research strand. Participants were asked to discuss what ageing meant to them, as a start point for investigating their views on bioscience in this area.

- Participants described ageing as the factors which affect people in old age, rather than a process that happens through life.
- They believed that physical, mental, and social elements are interconnected and all contribute to ageing.
- Ageing well was considered to be (to some extent) under individual control, based on making good health choices through life.
- Ageing has some positive side effects (like wisdom and appreciation of your body) – so they saw downsides as well as benefits to science which seeks to combat the ageing process.

2.3. Views on the challenges for science (meeting objectives 2a and 5)

- Diseases and illnesses were seen as unfair, unnatural, and a challenge to be beaten by science. Participants preferred the terminology of beating diseases rather than healthy ageing, though they did like the idea of beating age-related diseases, particularly familiar threats like cancer and Alzheimer's.
- The emergent concept of epigenetics was seen as a key frontier for science. This was the idea which most interested participants and sparked imagination across the whole dialogue.

2.4. Implications for Babraham's science strategy (meeting objective 2a and 5)

- Participants wanted Babraham to work to combat inequalities in health outcomes because they felt that illnesses and diseases are inherently unfair in their effects. They wanted this even though they understood that fundamental science is not the same as medical research.
- Focusing on epigenetics was seen as a priority by participants.
- Babraham could consider ageing research in its social context (i.e. not simply as a biological process).

2.5. Implications for Babraham's public engagement strategy (meeting objective 2b)

- The following ways of introducing ageing research to the public are most likely to interest them and help them understand the concepts.
    - Consulting the public about delaying illness and increasing resilience, not reversing or stopping ageing.
    - Consulting the public about ageing of people, not of cells; even when the project is at a very early stage or at a molecular scale.
    - Consulting the public about equipping people with the information they need to make good choices and increase their own wellbeing.

2.1. Overall views towards science

Participants brought **relatively limited experience and understanding of fundamental science** to the dialogue process. They started from the point of view of their own life experiences, and by focusing on their own priorities in health and ageing, were able to discuss strategy for the Institute on a general level. In the first part of the dialogue many found it hard to draw strategic conclusions or give advice to Babraham and many spent the first event learning about the detail of the individual science projects we showed.

Each table had some scientists present and these scientists gave different inputs throughout the Events. Each conversation naturally varied, as is usual in qualitative dialogue, according to the input of participants, facilitators and scientists. Within this variation, findings are relatively consistent across groups. Similar themes and ideas about fundamental science, ageing research, the case studies we showed, and the principles we discussed, were noted through the whole dialogue, at both the first and reconvened events.

As the dialogue discussions began in Event 1, participants tended to assume that most bioscience research was part of the process of drug development. They assumed that most research was applied, and that the aim was always to translate the research to products. Hence they tried to assess the value of the research projects they were shown by asking questions about the purpose of the research and what applications it would have.

Once the Babraham Institute scientists were able to explain the work they do and why they do it, participants quickly began to understand how basic, blue sky research plays a part in scientific advance. Participants expressed surprise at the complexity of fundamental bioscience and the detailed molecular level at which scientists look at the human body and other organisms. By the second event, participants particularly appreciated the complicated functions of the body. They saw the need for basic research, and valued it as a building block for further research and understanding.

> *"It's like climbing stairs. You want your scientists to keep climbing your stairs to find the answers."*
>
> (Birmingham)

By the end of the dialogue there was a general wish among participants to **protect and support fundamental research** at the Babraham Institute. They were happy that such research should be publicly funded. They supported the exploratory nature of the research, appreciating the possibility that unexpected, curiosity-driven findings will lead to fruitful outcomes a long time in the future.

> *"I think it's a necessity – nurturing possibilities. It is important to feed curiosity because it produces more questions and possibly more answers."*
>
> (Cambridge)

> *"Like Fleming, when he discovered penicillin, that wasn't intentional."*
>
> (Birmingham)

2.2. Views on ageing

Participants were explicitly told that for bioscientists, ageing is something that can start in the womb and affects the organism for its whole lifespan. However, they spontaneously described ageing as **challenges and experiences which affected people in *old* age** - when they had stopped growing and started 'declining'.

> *"You don't think of ageing at my age, but in another 10 years I'll think I'll be getting older. It feels like ageing comes into play when you're a bit older and then you think about it."*
>
> (Cambridge)

The following word cloud[12] illustrates the most typical words used.

We see that physical effects such as wrinkles and aches are associated with ageing, along with specific diseases, in particular dementia. Mental health issues like sadness and depression were also seen as part of ageing. The concept of **frailty** was relevant, though the word itself was not one of the most spontaneously used. Frailty was talked about in terms of physical lack of resilience and increased likelihood of injury. Participants' view of an older person was someone who becomes "more likely" to have an accident or become ill, because they have "slowed down" in body and mind.

However, linking together all these factors was the broader idea of a personal sense of **loss**, which was the concept referenced most often.

Ageing was seen as **social and cultural**, as well as biological and physical. Participants thought the decline associated with ageing was influenced by changes in lifestyle (such as retirement) and how the elderly are treated by others. The catalysts for frailty were seen as interconnected social, emotional, and physical factors.

> *"Ageing meant others will interpret what they think you think, and your opinion doesn't count any more. It's loss of autonomy."*
>
> (Birmingham)

> *"[Ageing is] a physical and mental change. Slowing down, frail, rely on medication, looked at differently."*
>
> (Homework)

Ageing well was considered to be under individual control (i.e. people should be looking after themselves). Many participants told us that nowadays we are all well-informed about how to keep healthy through diet, lifestyle and exercise. While they did not explicitly link this knowledge to the fundamental bioscience done in the past, when facilitators pointed out that this knowledge had originally come from basic bioscience, participants were enthusiastic.

All groups mentioned that people **live longer today** than ever. The average life span has increased in recent years, mostly due to scientific advances over the last century in disease treatment and nutrition. However, though participants acknowledged this, they had a gut instinct that the life span they were used to was a 'natural' one. It was very important to them that science should combat diseases and illness, but this did not lead to their making a connection between combatting illness, creating healthier ageing, and thereby increasing life span too.

[12]Made using www.wordle.net

Across the groups, indeed, people felt **ambivalent about the idea of increasing the life span**[13]. Where does this ambivalence about scientific advances to increase life span come from?

> *"I want to live longer, naturally live longer, but where is the natural barrier?"*
>
> (Birmingham)

From the dialogue, it was clear that gradual 'wearing out' was seen as the key experience of ageing. This felt such a central and natural part of life that participants could not believe they would ever be without that sensation of gradual **decline**. Even when they were told that science might manage to slow some of the cellular processes which are part of biological ageing, they could not imagine what this would actually feel like, so found it hard to connect the idea with any benefit to health or wellbeing.

The decline of ageing was also associated with some ***positive*** **psychological aspects** such as wisdom, a rounded perspective, and increased happiness coming from the very awareness of your fragility. Therefore participants did not actually want scientists to 'do away' with ageing in case it involved losing these experiences also.

> *"The older you get, the more precious and unreliable your body will become"*
>
> (Homework)

Some saw old age as a new, modern, stage of life, one which has become more visible in recent years. Elderly, sick and retired people represent a significant part of society. It seemed hard for participants to support the idea of minimising the biological effects of ageing through science, because they worried that this implied **devaluing the experience of older people**.

> *"You see the degeneration of ageing more than you would have seen in previous generations. This experience, of seeing your body degenerating, other generations didn't have."*
>
> (Birmingham)

> *"Ageing is not a problem, generally… it's about being tolerant of different age groups."*
>
> (Cambridge)

> *"I wish that society had a better image of old people. They are often forgotten about, ignored, or belittled in British culture."*
>
> (Homework)

Finally, a minority pointed out that conducting ageing research and looking at the human lifespan will have **societal consequences**.

> *"My great uncle is a farmer…I interviewed him and he said that only 25 million at a push could survive with the current resources in the world…we should stop being selfish, you do die, that's it… we are destroying ourselves with all this research to make us live longer".*
>
> (Reconvened)

2.3. Views on the challenges for science

While ageing was seen as natural (and not entirely negative), **illness and disease**, on the other hand, were seen as something to be combatted through science. Most participants had anecdotes of unexpected, severe or life-limiting illnesses affecting themselves and people they loved. Participants in both locations felt that one of the most difficult challenges of disease is the unpredictable variation in how it affects different people. One person could lead a healthy life, have social advantages and yet become ill very young; while another could smoke, drink, do manual labour and live to a ripe old age in good health. Cancer and Alzheimer's were felt to be particularly unpredictable in progression and effects.

[13] In Ipsos MORI's dialogue discussions on health and ageing for BBSRC in 2012, participants discussed what they saw as a healthy life. On that occasion, participants prioritised people maintaining their health into old age, but also told us that the current average **length of life** was in their view reasonable. Like participants in this dialogue, they did not want people to be living longer purely 'for the sake of it'. http://www.bbsrc.ac.uk/documents/1211-bbuh-public-dialogue-report-pdf/

There was real interest in science which explores genetic differences and heritability of diseases and the connection of this to individuals' resilience. Participants wanted to know what makes one person more likely to fall ill while another is well.

> *"If you know some family history, they might know what illnesses you are predisposed to. This can be useful. To prevent some of the diseases you could get."*
>
> (Birmingham)

When they learned about **epigenetics** they were particularly interested in the heritability aspect of epigenetic changes, seeing this as a key frontier for science.

2.4. Implications for Babraham's science strategy

Participants wanted Babraham's science strategy to consider illness and disease, and inequalities in health outcomes, even though they understood that basic bioscience is not the same as medical research. Fundamental bioscience was supported most enthusiastically when there was a clear connection between the work done and a potential benefit in understanding the body. Participants understood that this understanding, down the line, might lead to combatting illness or disease, and for them this was the real aim of such research. This aim was important because illness and disease were seen as humankind's natural enemies, unfair, and having unnatural effects (such as people dying young).

Interest in focusing on epigenetics: Because of this idea of unfair illness and a 'genetic lottery', epigenetics was particularly fascinating to participants. It was the idea that was the most interesting for participants in the whole dialogue.

Very few had heard of the idea but when they discussed it, there was interest in what the implications might be for people's life outcomes, especially how knowing about the epigenome might help us behave differently to avoid or minimise the effects of likely illnesses. Participants were interested in **linking the idea of epigenetics and healthy ageing together** as they felt this might provide some clues to why some people age better than others. They were particularly intrigued by the idea of repairing or replacing *"damaged genes"* as they put it.

> *"The genetic code, what we do to our bodies can not only have an effect on us, but also future generations. Fascinating from a women's perspective as we produce eggs then they are there for the rest of our lives and that's it."*
>
> (Cambridge)

> *"I found it really interesting because to me genes were either inherited or you just had it, I didn't know that the environment can affect your genes"*
>
> (Reconvened)

Babraham could consider ageing research in its social as well as its scientific context: Participants wanted research to take account of the political and social impacts of an ageing society, especially prioritising research which made older people more capable and able to take their place in society. They also wanted scientists to demonstrate that they are considering the population-level consequences of making changes to the way we age.

2.5. Implications for Babraham's public engagement strategy

Chapter 6 discusses public engagement in detail and describes the different types and styles of engagement which are possible and useful for Babraham. In this section we summarise briefly how the spontaneous views of participants towards health, ageing and science give some clues as to the frames of reference they use. Knowing these frames of reference may give Babraham some ideas for ways of introducing its research during public engagement processes.

Consult people about ageing in terms of delaying illness and increasing resilience: At Event 2, the consensus was that the most motivating way to describe fundamental research on ageing was to explain that science looks to *delay* some of the inevitable cellular processes and so make life *easier and smoother for individuals*. The aim is not to reverse or stop ageing as this is seen as extreme and not wholly desirable.

"As you get to a certain age, things happen to your body anyway, and if we can develop stuff to help delay that, but not cure it, then all well and good."

(Reconvened)

"We don't want to extend life. We just want to stay healthy."

(Reconvened)

"We all said we wanted to stop the ageing process, but the more we discussed it, we realised its more about how do we make ageing better, not stop it altogether."

(Reconvened)

If possible, Babraham should talk with the public about research combatting disease rather than slowing down the ageing process, as this is more motivating. The public may, however, be interested in hearing about how fundamental science starts to help us understand the age-related elements of diseases to combat those in particular, especially familiar threats like cancer, and Alzheimer's.

Consult the public about ageing of people, not of cells: The social aspects of ageing loomed so large in participants' minds that it was quite hard for some of them to separate out the parts of ageing which are purely biological. The scientists explained that ageing happens at a cellular level, and that basic bioscience might investigate or seek to alter the way that a cell ages. Some participants found it hard to understand the implications. They did not see that if this could be achieved, getting older might not automatically equate to feeling tired or ill; and that if this can be achieved then the years of your life in which you enjoy good health might be extended. Other participants, on the other hand, tried to link Bioscience to real-life implications a little too quickly. For example when autophagy[14] was introduced a number of participants jumped to the conclusion that because some *cells* benefited from reduced nutrients, then *people* could 'reverse ageing' by eating a restricted diet.

"My dad has done fasting for 10 years and does masses of exercise and he thinks it does really help and that it has given him more energy."

(Reconvened)

The overall learning from this is that participants tried to make sense of the science by viewing Bioscience in a larger, human-scale context. Therefore, the public are likely to be interested in fundamental research discussed in terms of its impact on human life, even if the projects themselves are basic, at molecular level, and very early stage.

Consult the public about ageing in terms of equipping people with the information they need to make better health choices and increase their own wellbeing: The idea of ageing research met with widespread support when it was expressed as helping people to help themselves, via greater knowledge or understanding of their own biology. This helps reassure that scientists are aiming to give older people more choices.

"Once you understand ageing you can start to look at either how to slow it down or to treat the symptoms. Being able to find ways of helping people with conditions they get as they get older – it comes back to quality of life."

(Cambridge)

These views form the backdrop for what the participants thought Babraham's priorities should be when choosing scientific topics to research. The principles which emerged will be discussed in the next chapter.

[14] Cells 'recycle' proteins and other cell parts effectively; one could say that cell ageing means the cell stopping doing this effectively.

3. Views on strategy: public principles for science and governance

What this chapter contains

Objective 2a for this dialogue was to gain insight to influence scientific strategy. This chapter summarises the key **principles** participants feel should drive Babraham's strategy and underpin research decisions for Babraham; in terms of its Institute Strategic Programmes and the specific projects within them.

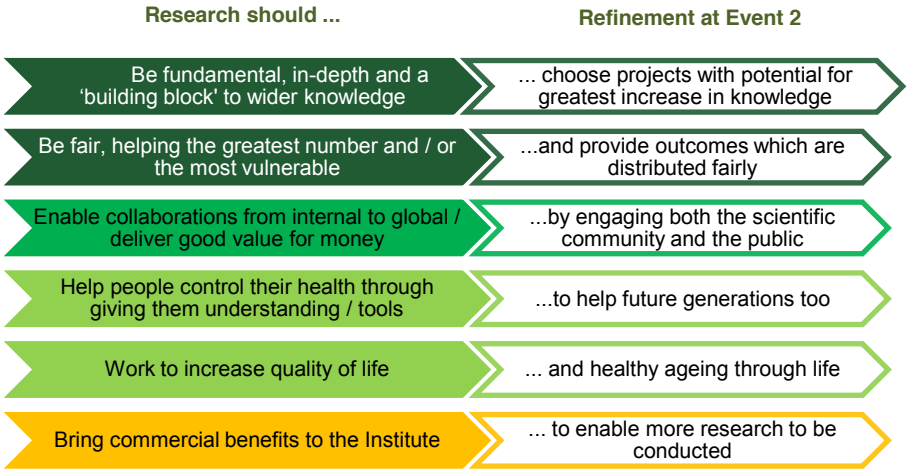
Then, we discuss participants' views of **governance**; how they thought Babraham should make decisions, take advice, and demonstrate accountability**.**

Key takeaways:

3.1. Scientific principles

Participants identified six **scientific principles** which they felt should inform the science strategy at the Babraham Institute. These were first shaped and identified at Event 1 and were nuanced and enhanced after further discussion at Event 2.

3.2. The diagram below summarises them. Green indicates strength of feeling. The final principle (in orange) tended to polarise views and was supported by some and contested by others.



3.3 Principles for governance

Participants identified two key ideas:

- They wanted Babraham to support projects which are in the public interest and which are most likely to deliver on the priorities identified above, when applying for grants.
- If the Institute is committed to accountability, it needs to enable scrutiny to make this commitment credible. This could involve taking account of a number of different voices (academic, media, lay, external experts) to bring a wider discussion of the interests of different stakeholders into strategy-setting.

3.1. How principles were identified

Case studies of the Babraham Institute's work were used in order to draw out public opinion on both strategy and detail of projects. Participants were shown eight case studies, two from each Institute Strategic Programme (ISP). These were used iteratively. In Event 1, facilitators and scientists explained the science and thinking behind each case study. Participants discussed what they understood, which aspects of the projects most interested them and which aspects of the science were important for them, both as individuals and within a social context. These discussions uncovered some common themes. On analysis, the themes were translated into 'strategic principles' by the project team, and presented back to participants in Event 2. Participants were then asked to comment on these principles, and to refine them according to their own priorities around the science Babraham should be conducting.

3.2. The principles in detail

3.2.1. Research which is fundamental, in-depth and a 'building block' to greater knowledge

Participants chiefly wanted Babraham to carry out scientific projects which investigate a particular fundamental area in depth and helps understand how things work. This was seen as the starting point for other research and discoveries. Participants felt it was strategically important and differentiating for Babraham to maintain its reputation as a centre of excellence for research into specific and in-depth fundamental areas.

> *"If you have a better idea of how something works you have a better idea of how to prevent [illness]."*
>
> (Cambridge)

In Event 2, the idea of fundamental research as a 'building block' was still strong and it was one of the principles to which participants most often referred. Participants in this event stressed the importance of assessing future benefits when making decisions about fundamental research. Participants did not qualify these benefits, but wanted to be reassured that there is a potential benefit, and that this would be for the greater good. Translating this into strategic advice, they wanted the management of the Babraham Institute to take decisions about which projects to support, based on the potential for the greatest knowledge to be generated through the findings.

3.2.2. Research which is fair, helping the greatest number and/or the most vulnerable

Ageing research was broadly perceived as fair because ageing affects everybody. Research into illness and disease was supported because illness was seen as inherently unfair in its effects (see section on implications for science strategy above, in Chapter 2). These beliefs meant that participants wanted Babraham to prioritise research which focuses on attacking illnesses, and in particular age-related illnesses like cancer and Alzheimer's. Participants thought that scientists should address diseases that affected the greatest number of people, the most vulnerable people, and those with the worst health outcomes.

Participants knew that Babraham conducts fundamental research rather than medical research, but appreciated the case studies they were shown which suggested that even at blue-sky stage, doing basic bioscience, Babraham's scientists are still considering the interests of groups who most feel the burden of ill health. This is why, for instance, the case study on why the immune system does not work so well in older people resonated well.

> *"I think it's really important, it's like a duty of care, if you're going to be more susceptible to get ill, someone should be finding a way to counteract that."*
>
> (Cambridge)

In Event 2, participants broadened their ideas on fairness and equity by saying that a good aim for the Babraham Institute should be to ensure (as far as possible) that the *fruits* of research are universally accessible to all. Though they learned in Event 2 that the system of science funding privileges competition, they also felt that receiving public funding places an obligation on science institutes to try and distribute their findings as fairly as possible throughout society.

"[Babraham should] unbiasedly aim to help everybody. And everybody is in the game and not only a few."

(Reconvened)

3.2.3. Enable collaborations from internal to global / deliver good value for money

In Event 1, participants across groups wanted to know that the bioscience was being done as quickly and effectively as possible. Many participants were surprised to learn the time it can take before translation of basic science into applied science happens, if at all, and wondered if the process could be sped up. Collaboration tended to be mentioned here because it was seen as a proxy for speedy and effective working. In this discussion, participants seemed to be drawing on ideas from their own experience of working in teams, even when they worked in very different sectors from the scientists.

"A benefit of collaboration is pushing each other, instead of one table working on their own".

(Reconvened)

"Collaboration brings faster, deeper and better quality research. This is because different departments have different areas of expertise."

(Reconvened)

Because of this, participants wanted Babraham to prioritise work which brings scientists together internally, externally, and internationally to collaborate and work on high profile areas. They felt this might help speed up the process by which research insights can be applied to human health problems. Others disagreed and thought that collaborating with outside interests, especially in the private sector, would influence the independence of the research.

"If Babraham worked more with more commercial companies… Would that mean that they would be less dependent on funding applications?"

(Reconvened)

Calling for collaboration was a way for participants to suggest that the Institute demonstrates accountability; working quickly and "*collaborating worldwide without restriction"* (Reconvened), would be a way of the Institute demonstrating that it is making best use of public grant funds.

In Event 2, participants learned about funding processes and accepted that to a certain extent, findings and research directions had to be kept private in order to secure grants in the globally competitive context. However, they still wanted collaboration wherever possible, to push forward the sum of human knowledge as rapidly as possible.

"Then collaboration is important. Research being shared and open so people aren't reinventing the wheel which seems crucial."

(Reconvened)

Value for money was also seen as a priority consideration. This was a related principle, it was also part of participants' desire for Babraham to demonstrate accountability for public funds. For example participants extracted a message from the case study on examining ageing in yeast, that working with yeast was a very cheap and effective way to do research; and were very positive for this reason. Value for money was mentioned as one of the criteria that Babraham, as a publicly funded institute, should meet to be accountable to its funders, tax payers.

"Yeast was important to us as it gives you the cheap basic form which you are going to work from. You get the cheap one to give the basic, the foundation before building the house."

(Birmingham)

3.2.4. The research gives people the knowledge to control their own health by giving them both understanding of how their bodies work, and tools to change things

Participants valued research which creates knowledge and understanding for individuals to help themselves make better life choices about health and wellbeing. They wanted Babraham to prioritise projects which might lead to the kinds of knowledge which would help bring about these outcomes.

> *"Giving people the opportunity to be proactive rather than reactive. Giving you more knowledge about how your body works, what you're eating what you're drinking, the kind of effects it has on your system. The more you can do to help yourself in the long term."*
>
> (Cambridge)

In Event 2, participants expanded on this idea to suggest that Babraham should prioritise work that helps individuals take responsibility for their own lives and the lives of future generations. They wanted the Institute to invest in epigenetics and any other research that would help individuals make decisions to help the health of their children as well as themselves.

> "*For some people that have a deficiency in a gene that's responsible for it, they'll get it younger than some others would. We've all got a responsibility, and it's not just parents, it's back to grandparents."*
>
> (Reconvened)

> *"[Babraham should] provide a progressive understanding of how its research benefits the future."*
>
> (Reconvened)

3.2.5. Work to increase quality of life through the lifespan

Research which directly or indirectly contributes to increasing quality of life was highly valued. As discussed, participants knew that Babraham's bioscience took place at an early stage and was curiosity-driven. But they still assumed the underlying 'deep' aim was to find more cures for diseases, and help diminish the various pains and types of suffering associated with the condition of life – cancer being most often mentioned.

> *"Fight these diseases and enhance people's lives."*
>
> (Cambridge)

3.2.6. Do research which can bring commercial benefits

Through the events it was explained that Babraham is able to commercialise some intellectual property which emerges from its research. Participants were initially cautious about potential links with pharmaceutical companies, and concerned in case pharma-led research might take directions aiming to create profitable products rather than remaining in the public interest.

> *"Fundamental is more important because you have a broader understanding. Whereas if you're trying to target a specific disease, it might be profit driven"*
>
> (Cambridge)

That said, there was interest in work that has brought commercial benefits. Even for those who disapproved of the profit motive, commercial viability was one of the themes grabbing their attention in Event 1. In Event 2 this principle became more controversial, and there was a mix of opinions. Some recognised that there is the need to make profit, and at best this can be used to fund future research and therefore in total to benefit a greater number.

> *"Commercial benefits... yes.. if you don't have commercial benefits you don't get funding and you can't do more research."*
>
> (Reconvened)

> *"Isn't the commercial benefits bit a plus? We are doing it for the greater good, for anybody... and if somebody wants to make some money, then good."*
>
> (Reconvened)

However, some felt that the principles of curiosity-driven research might be compromised by a profit motive, and such a motive also might mean that benefits were not fairly distributed. These people were a large minority who tended to express their views more passionately and to sway the groups they were in.

"The principle about the research bringing commercial benefits should not be there. It has to be at the bottom of the list. Get rid of the principle about being commercially valuable, research should not have a financial outcome."

(Reconvened)

In Event 2 there was a general feeling that Babraham should push forward areas of research which it feels are valuable. On hearing more about the funding process some participants feared that if priority areas of research happened not to be 'fashionable' areas to funders, there would be a risk that important work may not get funding. Hence, participants felt it was important for Babraham to create revenue for projects which meet the other priorities for scientific research but might not otherwise be funded. Participants were thus positive about revenue from commercialisation being used to support the Institute's work in general.

Participants were also keen for Babraham to maintain a reserve for contingencies, so that it can respond to emerging issues such as an epidemic like Ebola. Participants wanted the resources of basic bioscience to be made available, so that Babraham scientists could work alongside those developing cures and new medicines. They felt that if science institutes receive even some public funding they have an obligation to address a global crisis if one should present itself. Commercial work might provide a revenue stream which could help the Institute maintain this flexibility, outside its grant-funded projects.

3.3. Principles for governance

As well as the scientific principles for the Institute, the participants had views on how the Institute should make decisions, who it should take advice from, and how it should demonstrate accountability in its decision making. This section describes how the participants considered the choices the Institute has to make, and the kind of decision making they would like to see, within in the context of the funding environment in which Babraham operates.

Participants were given a range of information about funding and governance of the Institute.

- At different times on both days, scientists situated the discussion of their own projects in the context of how their work had been funded and any influence this had on the process.
- The case studies were discussed in terms of the strategic programme under which each fitted and the aims of these programmes.
- There was a specific section in Event 2 discussing funding for fundamental science. Facilitators asked directly at various points how Babraham should ensure that it was taking decisions in the best way; how it should ensure accountability for strategic decisions made, and how it should ensure that resources were allocated strategically across research themes and priorities.

This section draws together the findings from all these conversations.

3.3.1. Work in the public interest when applying for grants, as far as possible within funding constraints

Prior to Event 1, most participants had not thought about science funding. Once a detailed discussion began, participants realised that the grant funding system was very complex and most were surprised at the high-level, global, fierce competition for grants. Participants quickly expressed concerns about the process. Firstly, they thought that the applications process could lead to unfairness and lack of intellectual diversity, worried that only those with an already proven track record, or those in fields where there is a 'buzz' around ideas, stood a chance of getting through. They wanted to be reassured that the Babraham Institute would do all it could to ensure that the ideas of all scientists were given fair hearing, by supporting younger or less experienced scientists to push forward good ideas.

"But you're going to get further if [the area you are researching] is more fashionable!"

(Reconvened)

"It looks like the new guys don't have a chance.. what about the next generation of scientists?"

(Reconvened)

"So if they're not very good at writing they might miss out because it won't look like good science."

(Reconvened)

Secondly, participants spotted a tension between scientists' individual **research interests** and the **public interest** in decision-making around research applications. Participants absolutely agreed that scientists needed to follow their passion and instincts about which areas to focus upon, and felt that doing this would achieve the best results for science. Indeed, most believed that breakthrough discoveries are driven by enthusiasm and personal interest, as opposed to an established agenda. They wanted Babraham to support passionate and enthusiastic scientists when choosing which grant applications to sponsor and push.

"If scientists are made to research against their basic instincts, the enthusiasm is not there. You don't know what's around the corner. If we all start going down the same path, we are missing a lot of opportunities."

(Birmingham)

"Scientists should be free to research what they want to, not what they are told to do. Creativity comes from freedom"

(Birmingham)

However, in Event 2 some participants pointed out that the research project which best benefits the careers of a scientist, or best fits with the passion of a researcher, might *not* be the project which actually fits the priorities for science the public wants to see done (For example, as described in 3.2 above, the project with the biggest potential for basic knowledge increase, the project which provides the outcomes which can be distributed most equitably, the project where the results lead to individuals being better able to control their health, and so on). So, participants wanted the Institute to try and ensure that the individual scientist's interests would *not* be placed above the interests of the public in decision-making around research applications.

3.3.2. Babraham could place itself under voluntary scrutiny to make its decision making accountable

When participants were asked how Babraham scientists could be sure they were making the best decisions, they did not have a great deal to say. This was because they trusted the scientists themselves to make good decisions in the interests of science. Participants said that they themselves would not want the responsibility of making those decisions. Their further comments should be taken in this context; they believe that the system as it stands is likely to be sufficient, and there is no urgent call for the Institute to do anything very differently.

However, participants did feel the Institute directors could be more open about the way they make decisions, and let more voices into the process. They felt it was important that those in charge should be able to demonstrate that they are thinking about issues beyond their own projects and their personal scientific interests.

"We want [Babraham] to provide a progressive understanding of how its research benefits the future."

*(*Reconvened*)*

This could involve convening strategic discussions with informed members of the public, the media, or experts outside the world of bioscience or academia, to think about possible implications of different science programmes, or of emerging findings, in broad terms. This process might also involve lay people, as will be explained in more detail in Chapter 6 on public engagement.

"Some sort of review of whether and how the research is working. Does it need to be reviewed more regularly?"

(Reconvened)

4. Response to case studies in detail

What this chapter contains

A summary of how case studies were valued; which were seen as highest strategic priority, offering insights for science strategy, and which were seen as most interesting and easiest to understand, offering insights for communications within public engagement processes. Then, a grid of the case studies themselves.

Key takeaways:

4.1. Reactions to case studies

Participants' knowledge of bioscientific concepts was too limited for them to give strategic perspectives about the work of the Institute on the level of the **Institute Strategic Programmes** (ISPs; Epigenetics, Signalling, Immunology and Nuclear Dynamics).

Participants were shown eight case studies, two from each Institute Strategic Programmes (ISP). Participants used these detailed examples to draw out the principles they felt were important. At the analysis stage, two dimensions emerged as important and we have plotted them in the chart overleaf. The case studies were essentially seen in terms of the ***highest priority*** and the ***most interesting*** types of work.

- **Highest priority types of work**: Case studies on **how diet can affect future generations** and **how to train the body to kill cancer** were seen as high priority. The Institute's work on **an antibody to use against** cancer (**Vectibix)** was also seen as high priority for those who felt that an important aim would be to increase revenue through marketing intellectual property. The case study on **an important biological switch (PI3Kinase)** was also relatively high priority because it was seen as a fundamental, 'building block' study.
- **Most interesting:** Participants often focused on the practical detail of the project, rather than the conceptual science. Hence, the projects they found easiest to understand were often seen as most interesting. This illustrates the need to communicate clearly to allow the science itself to be understood. **How diet can affect future generations** included a human-level story which made it interesting. **What do chromosomes look like** appealed because of the visual aspects of the case study.

4.1. Overall reactions

Participants were shown eight case studies, two from each Institute Strategic Programme (ISP). The detail of each case study shown is found in **Appendix D.** The case studies are the following:

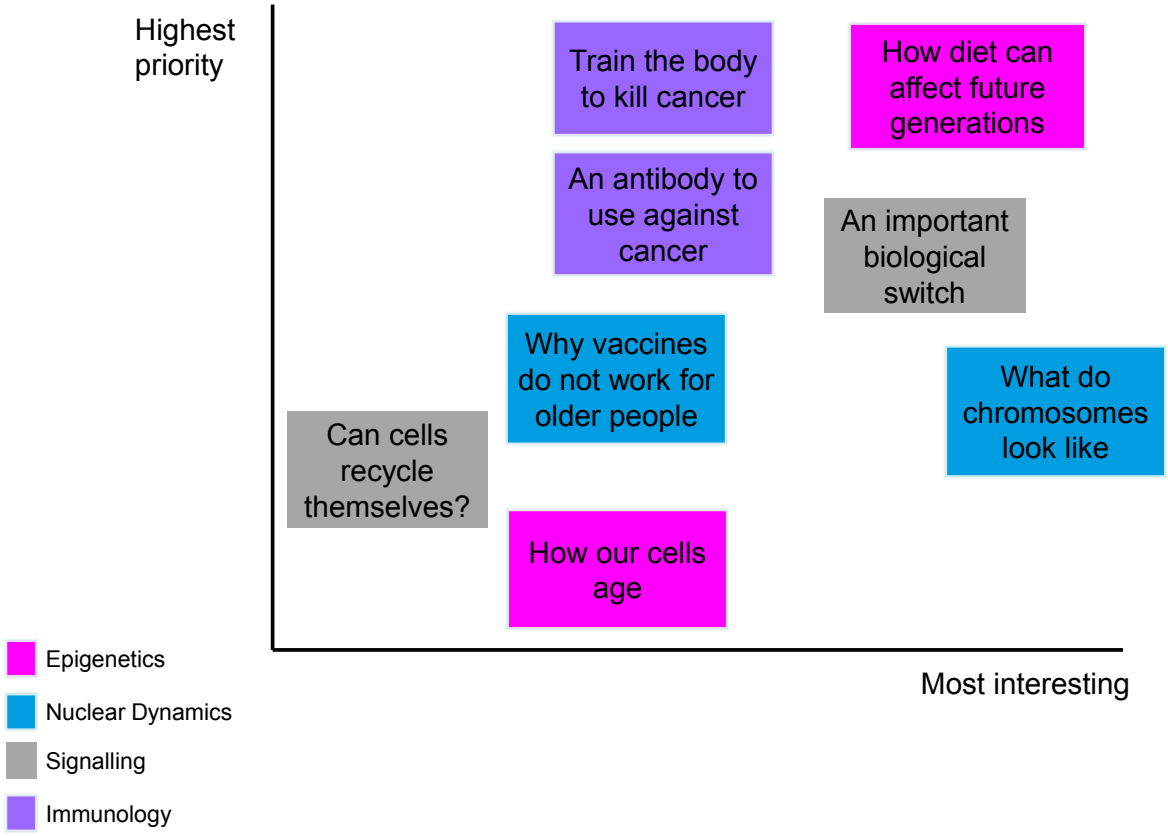
- **Train the body to kill cancer**
- **How diet can affect future generations**
- **An antibody to use against cancer**
- **Can cells recycle themselves?**
- **How our cells age**
- **An important biological switch**
- **What do chromosomes look like**
- **Why vaccines do not work on older people**

Participants discussed what they understood, which aspects of the projects most interested them and which aspects of the science were important for them, as individuals and within a social context.

When presenting the case studies, and in plenary presentations, the facilitators stressed the fact that each case study sat within a wider programme (the ISPs). Participants appreciated knowing this, but their knowledge of bioscientific concepts was too limited for them to give strategic perspectives about the work of the ISPs generally. Because of this, each case study was seen on its own merit, with little sense that the ISP behind it made a difference to response. There were some overarching views of the ISPs:

- **Immunology** seemed the most familiar idea, as some had a lay understanding of the immune system.
- **Epigenetics** was seen as a new and very interesting field, some had a little knowledge of the terminology around genetics which they applied to this new idea.
- **Nuclear Dynamics** was challenging as the terminology was not known; many did not know what the nucleus of a cell was or what you might find within it.
- **Signalling**, again, was not well understood, as an unfamiliar scientific idea to all the participants.

Within this limited sense of the ISPs, participants placed the case studies in order through a process of discussion to aim to reach a broad consensus. In the dialogue, participants listed in order which they felt were most ***valuable.*** We have pulled apart the dimensions of this value in analysis - participants were talking about which case studies they felt were **highest priority**, but also about which they liked because they thought the work was most **interesting**, and potentially most **engaging**.



4.1.1 Highest scientific priority

The y-axis shows which case studies the participants felt best expressed the **priority areas** of science they thought were important. Case studies on **how diet can affect future generations** and **how to train the body to kill cancer** were seen as high priority. The Institutes' work on **an antibody to use against cancer (Vectibix)** was also seen as high priority for those who felt that the Institute should increase revenue through marketing intellectual property, though this was contested; not everyone felt this way.

The case study on **an important biological switch (PI3Kinase)** was also relatively high priority because it was seen as a fundamental, 'building block' study.

4.1.2 Interesting and engaging

The x-axis axis shows which case studies felt most **interesting and exciting** and most relevant to participants' lives. This potentially gives clues as to the types of narratives which may be compelling within public engagement activities, see Chapter 6.

In Event 1, participants often focused on the practical details of the project (yeast, or babies being born small) rather than the conceptual science. This meant that the case studies which were easiest to understand also seemed the most interesting to participants. The learning here is that it will be important to communicate scientific projects clearly if the public are to be engaged with the science behind them. Some of the case studies did this well; for example **how diet can affect future generations** seemed to have a particular human-level hook which made the story interesting. **What do chromosomes look like** was also very appealing because of the visual which came with the case study, which helped participants themselves have the feeling of learning something new as they could see for themselves how the visualisation led to new thinking about how the chromosome works.

The remainder of this chapter summarises each case study.

4.2. Response to individual case studies [15]

Overall reactions	What did it express about priorities for science?	What are the implications for public engagement or communications?
Could our diet affect our grandchildren? (Epigenetics)		
Epigenetics was the idea of most interest and seen as highest priority for participants in the entire dialogue. Beyond this widespread interest, there was a noticeable difference between the groups. In Cambridge the level of awareness about genetics was overall higher. Participants quickly recognised how the theory of epigenetics sheds new light on heritability of genes; whereas in Birmingham, participants struggled to grasp the principles, and focused on the concrete example given.	**Take control over health:** For those with no knowledge of science, the idea that you can take control over not only your own health but that of your children was an interesting, even shocking, paradigm shift. **Fair research:** In both events, participants were interested in the idea that this project has the potential to affect the greatest number of people both today and in future. *"I thought it was really important as it will be affecting future generations and might give us insights into why we maybe have certain conditions."* (Cambridge) **Cutting-edge science:** Participants valued the idea of Babraham doing truly cutting edge science in areas where the implications are not known. For those with more knowledge, the notion that new thinking can complement and enhance the theory of evolution was a very intriguing notion.	Epigenetics has the potential to interest the public, both in terms of learning about what Babraham Institute does; and in terms of getting involved with discussions on the implications of this research. This may also provide a way to explain what the ISPs in general do and to engage the public with strategy on an ISP level. For those who knew a little about genes, discussion of heritability of traits was by far the most interesting aspect of epigenetics. This could potentially be a good way into the topic when communicating it in future. In particular, it was mentioned that this emergent knowledge should be brought into wider education. This is so that children (and adults) can experience scientific discovery 'as it happens'. *"At school you're told it is DNA that passes down, but not the environment. So this is new and different to what I've been taught."* (Cambridge)

[15] Full case studies are in Appendix D

Overall reactions	What did it express about priorities for science?	What are the implications for public engagement or communications?
Can we train the body to kill cancer? (Immunology)		
Participants were very interested in this idea. It was remembered, mentioned in homework tasks and in Event 2. It was also considered to have a widespread impact.	**Take control over health:** Participants perceived the idea of *training* an individual's immune system to treat illness as very ingenious and somehow 'natural'. *"How we train the body was also important to us– to promote how the body cures cancer. It should be good to do research into medication, but better to train our body".* (Birmingham) **Value for money**: Participants thought this research would provide value for money; they believed outcomes from this research would eventually relieve pressure on the NHS and save money for taxpayers. *"I think this research is important because you're talking about how the body itself can help itself, which could hopefully save money and time.*" (Cambridge) **Fair research**: As anyone can be affected by cancer, a potential benefit of this research was seen to be 'fairness'. Furthermore, some participants were fascinated by the idea that understanding the genome could help future generations to fight the 'unfairness' of genetic diseases. *"It would be helpful to get people's genes when they are born. There are children who get cancer, then we had all the info when they were born, let's see what it has changed over the duration of their life, so that we can help future generations."* (Birmingham)	Babraham could use this case study as a jumping-off point for a discussion of 'naturalness'; also to link the basic research to more downstream research in developing medicine and treatments, as fundamental research can help us to understand the body's ability to fight illness.

Overall reactions	What did it express about priorities for science?	What are the implications for public engagement or communications?
Important biological switch, PI3K (Signalling)		
Seen as a clear, comprehensible example of fundamental research and a very good example of how fundamental research is the starting point for other research.	**'Building block':** Participants liked the fact that proteins are the "building blocks" for life. *"The fundamental protein PI3K would mean that would be right at the top as it is the building block for all the other research."* (Birmingham) **Area of specialism:** Participants appreciated hearing about a specific area in which Babraham Institute excelled and which has already led to concrete benefits through application into other research. **Creating better quality of life**: This case study was linked to the principle of doing research which eventually could create better quality of life. *"I am interested in all of this, really. If it gets answers to these questions it will make us more knowledgeable and help us to fight diseases. In particular inherited diseases are personally interesting."*(Cambridge) **Fair research:** It was perceived as 'universal' and seen as fair, as all of us age and might get cancer one day. *"Everybody has cells, so it will be beneficial to all of us. Most of us are affected or know somebody who is affected by cancer; we are all affected by the ageing process."* (Cambridge)	There is the potential to use the PI3K story to communicate the complexity of how our cells work. The public see it as most valuable when they appreciate that research here could be linked to fighting diseases such as cancer. The case study involving the product Vectibix helped here, as the two together enabled participants to see how PI3K work could lead the Institute to become expert in this area.

Overall reactions	What did it express about priorities for science?	What are the implications for public engagement or communications?
An antibody to use against cancer, Vectibix (Immunology)		
Participants appreciated the concrete example of translational research and liked linking it back to the PI3K area of work.	**Fundamental research and increasing quality of life:** Participants were very appreciative of this work, which they saw as both fundamental, and having led to concrete benefits to quality of life. *"It's a good example of why it's good to research for research's sake. You can't get your answer within a fixed timescale - its takes as long as it takes, and there can be a very good payoff at the end."* (Cambridge) **Area of specialism:** Participants liked the idea that Babraham Institute had had reaped the (financial) rewards of specialism. **Fair research:** The research was seen as fair and benefiting all in society, because of the connection to cancer treatments. However, there were contrasting views on the extent to which collaboration between Babraham Institute and pharmaceutical companies could speed up the scientific process and provide good value. Some participants were curious and positive about the idea, while others were concerned that to search for commercially viable ideas would sway the choice of research projects carried out in future.	When discussing its engagement with the commercial world, Babraham Institute should stress its not-for-profit status. There may also be scope for further discussion with the public on the role of commercial and public interests in fundamental research; with more knowledge of the research translation process, the public may be able to move beyond knee-jerk negative reactions to 'Big Pharma' and give more nuanced perspectives.
What do chromosomes really look like? (Nuclear Dynamics)		
Participants initially liked the idea, and valued it as important as a good example of an early 'building block'. However this case study was not recalled and discussed as often at Event 2.	**Fundamental research which uses innovative methodologies**: In Event 1, this area of work was explained through visual stimulus and also a video showing the visualisation itself. This helped participants see a new visualisation of how things worked was immediately useful to scientists. For those who remembered this case study at Event 2, it was this imagery which stuck with them. *"I think it helps us as the taxpayer to realise things aren't as we've always been told they are. There are people out there working to look at things differently and inform us of the development."* (Birmingham)	This case study shows how powerful it can be for participants to visualise the outcomes and see the new knowledge for themselves. There may be potential to use this approach when communicating other work with the public.

Overall reactions	What did it express about priorities for science?	What are the implications for public engagement or communications?
Why do vaccines not work for older people? (Nuclear Dynamics)		
Some thought this was fundamental research, and other thought it was applied, therefore it was valued in different ways by different people.	**Improve quality of life**: There was no consensus on whether this research was mostly about exploring the effects of ageing on people's bodies or seeking to identify better vaccines for older people. *"I would say it is fundamental, as technically it doesn't lead to a treatment. It's looking for an understanding."* (Cambridge) *"I'd say it is more disease driven. If they weren't looking to vaccinate against a disease they wouldn't be doing the research. So depends on motivation. "* (Cambridge) When it was seen as fundamental research which ultimately may lead to better vaccines, participants were very positive about the case study. This is because they tended to link it with improved quality of life. It was considered fair and in the public interest to do this kind of research. *"You'll all be old one day, so you'll have a vested interest."* (Cambridge)	While innovations in techniques are interesting in principle, it was hard for participants to take on board about the sequencing technique used. Communication perhaps needs to be extremely simple and take people through projects in small steps. There was general interest in science looking at a better understanding of the immune system. Participants felt they knew about the immune system, but their understanding was fairly basic.
Cells can recycle themselves, Autophagy (Signalling)		
This case study was seen as interesting and liked in Event 1, but tended to be discussed with slightly less enthusiasm than other case studies. Participants had fewer follow-up questions than they asked about other studies.	**Improving quality of life and fair research:** Those participants who grasped the importance of the science done here referred to the value of its potential to cure cancer – a fair benefit, improving quality of life, as many people are affected directly or either indirectly by cancer. *"Autophagy was important to us. If you can recycle and train the cells, then you can train them to cure cancer and build them to fight cancer – then find a vaccine against cancer".* (Birmingham)	Framing of this work may need to explain the connection between autophagy and ageing more clearly. If this can be communicated, there is scope to discuss the potential of this research in furthering work around disease and ageing generally.

Overall reactions	What did it express about priorities for science?	What are the implications for public engagement or communications?
How our cells age (Epigenetics)		
Participants liked this case study and were fascinated by the idea of yeast being used in the lab. However, they tended to discuss the practical details of the method (e.g. cost-effectiveness, yeast genes are similar to human genes) rather than the implications of the innovative discovery (older cells responding better than younger ones to sudden environmental changes).	**Value for money**: when it was explained that yeast allows Babraham Institute to conduct research in a quick and cost-effective way, participants become more positive and felt this work was a good use of public money. Those participants who understood this remembered the case study when they returned for Event 2. *"From the last meeting, I took away how complex it is. The yeast stood out for me - how scientists have to do so much."* (Reconvened) Participants were also distracted from the core ideas by overly focusing on the details of a restricted diet. "*As a lay person you can relate to this one. We know that improving diet has a positive effect on many other aspects of your life. But then this can go too far – look at the problem of anorexia, for instance*". (Birmingham)	The fact that it is relevant that participants were distracted by the detail of the yeast suggests that details are important, either for drawing people in or for losing them. As with autophagy, it may be useful to link the story of cells ageing with human experience and find a way to link the work done here with the heritability aspect of epigenetics.

5. Openness and transparency around animal research

What this chapter contain

This chapter examines participants' views of animal research and their thoughts on how the Babraham Institute could best demonstrate openness and transparency in the context of its work with animals.

Key takeaways

5.1. Animal research and the commitment to openness

Babraham has committed to openness and transparency in its animal research. The dialogue explored how participants thought these principles of openness and transparency could best be applied to the work done at the Institute (mostly with mice). This helped meet the objectives of raising awareness (objective 3) and demonstrating best practice in openness (objective 5), as well as gaining insight for strategy (objective 2).

5.2. Public views

- Most understood why Babraham was making a commitment to openness and transparency. They felt that this would help address any negative feedback proactively.
- Overall, participants felt animal research was necessary to advance science and was acceptable when carried out ethically and when well regulated.
- The main driver of trust was that participants believed the scientists who were there on the day; they personally assured participants that they cared about the animals, considered ethical issues, and adhered to the '3Rs'.
- In order to be reassured, some requested more information about:
    - The level of suffering experienced.
    - Why mice are good models for human biology.
    - The numbers of mice really needed.
    - Why animals have to be killed at the end of a project.
    - What is involved in breeding transgenic mice.

5.3. Implications for Babraham are largely around communication, within the public engagement strategy (objective 2b); effective communication of animal research would involve answering the reassurance questions above.

5.1. Animal research, Babraham and the need for openness

Babraham Institute has joined forces with other institutes, universities, charities, umbrella bodies, pharmaceutical and health science companies, in signing a concordat on Openness on Animal Research in the UK. [16] The Concordat aims to promote best practice within the bioscience community, in terms of transparency and openness within animal research.

The dialogue explored how participants thought transparency and openness could be applied to the work done at the Institute. Babraham uses mice and nematode worms in the conduct of research and in particular uses a colony of ageing mice.

In Event 1 a number of case studies touched on the use of animals in research and participants were probed around this. In Event 2, a whole section was dedicated to the discussion on animal research. Participants were presented with general information on animal research worldwide and in the UK (taken from the Concordat's stimulus materials[17] from its dialogue on openness in animal research, a previous study carried

[16] http://www.babraham.ac.uk/about-us/animal-research/concordat
[17] http://www.understandinganimalresearch.org.uk/files/1214/1041/0135/appendicies-to-openn.pdf

out by Ipsos MORI), and then with specific information on how Babraham conducts animal research. We explained specifically in the '3Rs'[18] and that the Babraham research with animals adhered to these principles (stimulus available in **Appendix D)**.

This helped meet the dialogue objectives of raising awareness (objective 3) and demonstrating best practice in openness (objective 5), as well as gaining insight for strategy (objective 2).

5.2 Attitudes towards animal research at Babraham

A minority of participants thought Babraham did not need to be particularly open or transparent; because there is already regulation in place, and because, more fatalistically, the public cannot influence anything anyway.

Most participants believed that Babraham should be open about animal research and thought that this was an ethical duty.

> *"We should always think about transparency when we're causing pain to a being"*
>
> (Reconvened)

Others believe that transparency and openness would help the Institute be proactive in the face of negative publicity. Withdrawing from communication on animal research might mean that critics interpret silence as having something to hide.

> *"I think the more transparent it is, the more likely people are to be understanding and accepting, if people are able to access what research is being done."*
>
> (Reconvened)

A few pointed out that because there are some groups who object to animal research, Babraham should not publicise its work – as it would draw attention to a contentious topic.

> *"I don't think it needs to be advertised because I don't think it's something that Babraham needs to promote."*
>
> (Reconvened)

However, there was a widespread agreement that scientists should put most time and energy into conducting their research and making best use of their funding grants by doing science, rather than spending too much effort into communicating animal research.

In Event 1, few mentioned the role of animals until prompted. Participants did not spontaneously question or ask for more information. A small minority mentioned that animal research was worrying, or made them feel unhappy. All agreed ultimately that when the use of animals is necessary to advance science and it is regulated, then it is acceptable[19].

> *"Some research you'll need to use animals some you won't, some will need to use animals and that's fine."*
>
> (Birmingham)

In Event 2, a greater spread of opinions emerged as we prompted participants to think about the issues. Nevertheless, at the end of the day the message was the same. To participants, animal research is acceptable when it is necessary, carried out ethically and regulated, and the participants trusted that these factors were in place at the Institute.

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[18] The 3Rs are: **replace** the use of animals with alternative techniques, or avoid the use of animals altogether; **refine** the way experiments are carried out and the way animals are housed and cared for throughout the animal's experience, to make sure that suffering is minimised and animal welfare is improved; **reduce** the number of animals used to the minimum necessary, so that the scientific question can be answered robustly, but using fewer animals or more information obtained from the same number of animals.

[19] It is useful to note that the animal research was presented in the context of research needs and the harm to the animals was not introduced specifically or stressed; the Concordat's dialogue findings suggest that had we discussed harms initially, views might have been different.

> *"I don't know. I really don't know. Half of me think 'poor little mouse'. And the other half think 'haven't we not done this, this research would have not been discovered."*

(Reconvened)

The main driver of support was **trust and personal connection**. Participants trusted the scientists who were there on the day, who personally assured them that they cared about the animals, considered ethical issues, and adhered to the '3Rs'. The best advertisement for ethical research, therefore, is to show that the scientists themselves are committed to best practice.

There were also some specifics where participants wanted more information in order to feel reassured.

Level of suffering: There was a real concern about how much mice suffer and whether this is possible to detect and measure. Participants wanted to know that the suffering was taken into account and considered in the licencing. The tumour / chemo mouse work was seen as the most unacceptable or upsetting – though also seen as part of an experiment with the most beneficial potential application. They were reassured to know from scientists that it is possible to measure pain in animals. They needed to know that there were people behind the process and wanted to hear about the team dedicated to animals' welfare.

> *"The image I would like to see is that the person looking after them would care for them as I would if they were under my care. If you could see the public face of these people who do this sort of work, you could tell a lot from just seeing how they are around animals. If you have a good core of people, then animals will respond to them, even rodents."*

(Reconvened)

Useful models: Even when scientists explained that the genetic structure of mice and humans are similar enough to draw comparisons, there were some questions on why mice specifically are used at Babraham. The Institute might need to raise awareness of the reasons why mice are good models; and link this discussion to messages around animal research helping achieve greatest benefits.

> *"How much do we really learn [from observing and studying them]? Shouldn't you be doing this on a human?"*

(Reconvened)

Killing mice: The idea that mice would be killed after the experiment was unpleasant news to many participants. As in the Concordat dialogue of 2013, most participants did not realise that mice need to be killed at all. Babraham might need to convey the message as to why they do this, and stress that mice do not simply undergo more and more experiments until they are killed / until their suffering reaches unacceptable levels.

> *"If you were open, I think you'd have to explain about how they were killing them. I didn't realise that they would be killed after the tests. The explanation needs to be well prepared."*

(Reconvened)

Number of mice needed for testing: A few participants wondered why so many mice are used. They though that, as mice are all the same, there is no need to repeat the same experiments with other mice. Participants were explicitly asked whether Babraham should adhere to the principle of reduction of numbers or whether the scientists' first duty should be to designing a robust experiment. Most participants had little to say about this, perhaps not appreciating the trade-off, but broadly trusted the scientists to make the best decisions. Babraham might want to clarify the scientific reasons behind the numbers chosen; not arbitrary choice, but in order to design robust experiments which reduce the need for duplication of research and thus adhere to the 3Rs.

> *"How many mice do you use because one might act differently to another?"*

(Reconvened)

Why mice are bred at all: Although participants had not previously considered **breeding programmes** as part of animal experimentation, most accepted the idea that this is an appropriate thing to have. However

there may be a need for more communication on this, given that it is a core part of the transgenic mice programme.

> *"I think breeding ageing mice is valuable. Following it all the way through the different ages of the animal would give you a better overview."*

(Reconvened)

5.3. Implications for Babraham's public engagement strategy

Because there was broad support for animal research any implications are largely around communications messages. Effective communication on openness and transparency in animal research at Babraham would involve answering questions to reassure the public:

- **Is research on mice relevant and important?** There are many specific examples of how studying mice contributes to fundamental knowledge of biology, and even though considering the 3Rs, scientists still sometimes judge that using mice is a justifiable action given the potential benefits of the research.
- **Is research with mice carried out ethically?** Continue to promotes: that the Institute is part of the Concordat; that is subject to strong regulation; and make reports and audits visible.
- **Do scientists care about the mice and respect their sacrifice?** Scientists do not want to see them suffer unnecessarily, and the specific scientists working at Babraham care about this, witness and monitor their pain.

6. Public engagement

What this chapter contains

Public engagement is a multifaceted concept and there are various different (contested) definitions. This chapter first unpacks the idea of 'public engagement'. We then describe how the learning from the public dialogue suggests how the different types of engagement could be best achieved, and how this could fit into the framework of the Institute's existing proactive public engagement strategy (objective 2b).

Key takeaways

6.1. What is public engagement?

Public engagement can be divided into **communication**, **consultation** and **participation.** This dialogue illustrates how the Babraham Institute could best carry out engagement in all three areas.

6.2. Communication

Levels of knowledge about bioscience and the Institute's work were very low. Key areas to communicate to the public are:

- Who scientists are and what they do all day.
- The scientific approach and process.
- Sharing cutting edge science as it happens.

Dialogue participants asked for fun, informal communications approaches. Babraham needs to be aware of the challenge in getting the public involved in questions of bioscience and giving them enough information, while at the same time communicating in a simple and interesting way.

6.3. Consultation

Researchers and participants had reservations about how far the public could meaningfully be consulted on very detailed issues of science. Nevertheless participants felt they should be able to feed back their views to scientists, in the context of a two-way conversation where both sides could question the other and reveal their perspectives. Relevant subjects would be: ethical debates; or the implications of research findings.

For best results, the problems would be couched in terms of human effects rather than in the language of molecular bioscience. Appropriate channels were felt to be Q&As, interactive exhibitions and online forums.

6.4. Participation

Participants saw some opportunities for a deeper 'collaboration' with the Babraham Institute. They felt the public could be engaged with some specific areas of work and might become informed enough to join strategic discussions, for example ethics, epigenetics, and disease-driven vs fundamental research directions; and that these were subjects where lay opinions would be valuable and should drive strategy.

They felt it was incumbent on a publicly-funded Institute to allow the taxpayer some say in decisions on how funds are spent. The public felt it was important for the credibility of public engagement that scientists should be as involved in these engagements as possible.

6.1. What is public engagement?

Science communication practitioners use various frameworks to explain different types of public engagement with science. Rowe & Frewer's[20] model identifies public engagement in terms of different kinds of **communication, consultation** and **participation** and details a number of mechanisms within each and factors affecting the efficacy of processes. The Public Engagement Triangle[21] describes **transmission, receiving** and **collaboration** as the three broad types of public engagement. Pieczka & Escobar[22] also assert that there are three facets to engaging society with science, public **understanding** of science, public **engagement**, and public **dialogue**. In whatever way we describe the various types of engagement it is important to note that one is not 'better' than another. Instead, different types of engagement serve different purposes. They are likely to create different outputs and have different impacts.

The Babraham Institute has a longstanding commitment to public engagement. In terms of science communication, it has demonstrable metrics (numbers and frequency) in terms of its outreach activities, it runs annual events and has commitments to schools and community groups. One stated aim for this dialogue was that there may be a need to increase "two-way" engagement as well as all the work that is currently done to communicate the Institute's research.

The sections below describe how this dialogue sheds light on the potential for different types of public engagement. We describe how the Babraham Institute can enhance its existing public engagement strategy by: proactively **communicating** its work to the public; **consulting** with them and find out their views efficiently on relevant strategic issues; and also enabling their ongoing **participation** in decision-making.

In this section the implications for the Institute are integrated within the presentation of findings.

6.2. Communication

6.2.1. Information as a prerequisite to any other engagement

At the Researcher Day, scientists mentioned a number of interesting engagement activities in which they had previously been involved. They described positive experiences of talking with engaged publics at science festivals, and with children and young people at schools. These activities had been designed to inform people about the Institute's work in a lively and interesting way, and get across as much content as possible so that people could get a good grasp of aims and findings of experiments. These communications activities were seen as a success by researchers.

For many participants, effective communication like this, at a fairly basic level, would be a **prerequisite** to being able to get involved in any other form of public engagement. As described in Chapter 2, levels of knowledge of science were low, as was knowledge of structure of research, the research process, and how research is funded. To participants, scientific research could be seen as closed off to the outside world and something which non-scientists are not exposed to. The dialogue experience opened their eyes, and in this way met Objective 3 for the process, to raise awareness of, and highlight the importance of, the Institute's work.

> *"The whole day has been surprising. I didn't have any idea how much research has been going on!"*
>
> (Cambridge)

> *"It's a new element of science that I didn't understand or know about."*
>
> (Reconvened)

The Birmingham group had, overall, a lower level of awareness of life sciences and low knowledge of fundamental science more generally. The Cambridge group contained a higher proportion of individuals with some experience of science, some of whom were more comfortable discussing conceptual questions.

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[20] Rowe G and Frewer LJ. (2005). "A Typology of Public Engagement Mechanisms." Science, Technology & Human Values; 30(2): 251-290

[21] Colbourne, L. (2010) Science for All Conversational Tool (BIS)

[22] Pieczka, Magda and Escobar, Oliver (2012) Dialogue and science: Innovation in policy-making and the discourse of public engagement in the UK. Science and Public Policy, 40 (1). pp. 113-126

"In Cambridge it's different. If you swing your handbag you'll hit 10 PhD students."

(Reconvened)

Very few people, if any, knew what the activities and aims of the Babraham Institute were. A small number of the Cambridge participants had heard of it mainly through having seen the campus.

"We'd heard about the institute but didn't realise how back to basics the research was."

(Reconvened)

Regardless of these differences, participants were generally interested in the topics discussed, and excited to learn about scientific principles and discoveries. Some did struggle to engage with the more complex case studies, but this did not prevent them from contributing to the discussion.

As the day developed, positive opinions towards the work of scientists grew. Participants were surprised and interested to find the scientists so committed, enthusiastic, and expert on the specifics. **Meeting the scientists** was the aspect of the day that participants liked the most, and simply being exposed to the ways scientists put things and expressed themselves acted as a communications tool in itself.

"I found that interesting how he focuses himself on finding something wonderful."

(Reconvened)

"If I had to choose a public engagement activity to get young people inspired with epigenetics. I would choose a show…talks that are interesting and interactive."

(Reconvened)

Face to face interaction also increased **trust**. When discussing animal research, for example, in one group, a scientist pointed out that some colleagues preferred not to work with live models; the group was impressed that ethical considerations were considered and that scientists had a human reaction to their work. Hearing this personal anecdote had the effect of increasing trust, and the knock-on effect was that views of animal research became more positive as a result.

Participants felt that the process of uncertainty and questioning by which science produces knowledge should be better understood. Some younger participants, and some who were still involved with education, said that they had found out about some of this, but they were in a minority. People asked questions which, at bottom, were about **how science produces knowledge,** as well as about specifics of funding and the research process.

"If somebody produces a paper in your area of interest, does this help you move forward? You can jump from where you are to their bit and it speeds everything up?"

(Birmingham)

"With your finds, do you have to report back at certain stages?"

(Reconvened)

"So the projects are they organic or are they something you have a clear view on?"

(Reconvened)

"What do you do with all your research? Why don't they do it quicker? Why can't you tell the results straight away?"

(Reconvened)

As the day progressed, participants appreciated that the Institute does cutting-edge science in areas where the implications are not always known. They were keen for scientists to share the sense of possibility and opportunity this brings with the public. In Event 1, various participants mentioned that emergent knowledge should be brought into education as soon as possible so that children (and adults) can experience scientific discovery 'as it happens'.

> *"[Feeding back on a discussion:] What people found most interesting was what was new – doing things because it's new, stuff we thought was different when we learnt it at school. It's completely changing the way we think about something."*
>
> (Cambridge)

This could inspire the next generation of science, drawing young people in to science careers.

> *"If this scientist here got inspired when he was 13 or 14 by Crick, then we need to teach the same to kids. We need kids to grow up wanting to be in the lab and not on x factor."*
>
> (Reconvened)

This would also have the effect of helping the public to understand more about the scientific method. This would make them a more **informed audience** for other types of engagement, such as consultation or shared decision making.

The challenge expressed by some researchers in the Researcher Day was that they wanted to know how the public could be helped to see what they see, which is that bioscience is "**sexy**". In the context of areas like cosmology, which they felt get more airtime in the media and more public approval, they sensed that bioscience is underappreciated. This dialogue suggests that the more scientists can be involved in sharing the cutting-edge science they do, as it happens, the more the public are likely to feel that the whole area is exciting and relevant, and have more of an appreciation of how knowledge is produced and the kinds of dilemmas that scientists might face.

6.2.2. Communications channels

Participants in Event 2 were presented with a list of public engagement activities already run by the Institute and asked them to rank them according to how much information through these channels might increase their trust in science. The most popular activities were online resources for schools; games and apps; public exhibitions; making YouTube films; school visits by BI scientists; public debates. Participants wanted such activities to be: targeted to the 'non-sciency' person; informal and easy to digest; and fun and interactive.

Participants – and especially those in Birmingham - thought that public engagement activities should be targeted to all people, and especially to those who would normally not be interested in science.

> *"Try to attract not only 'sciency' people. There might be many people not knowing much about science. Market it to the masses."*
>
> (Reconvened)

There was an overall feeling that there is not enough publicity about science activities, especially among participants in Birmingham. They complained that they are not exposed to many science festivals or events. This is the reason why YouTube videos were considered a powerful public engagement tool to get people inspired with science.

> *"Making YouTube films… I would rank it high, as it is about getting people who would not normally be interested in science."*
>
> (Reconvened)

Linked to the point above, participants felt that public engagement activities should be informal and use lay language, so that *"You don't feel that you need to know the answer"* (Reconvened). When it comes to designing the content of the activities, it is key to ensure that the information is easy to digest and broken down into simple messages. Activities with the public might need to ensure the information is fed in gently, and that no previous knowledge of science is required.

6.2.3. Some feedback on the Immune Army website

In their homework, some participants chose to explore the Immune Army microsite[23] and to feed back what they found most interesting and most difficult to understand. The site was designed for a specific exhibition

[23] http://immunearmy.babraham.ac.uk/

and focused on one area of Babraham's work. Nevertheless, general learning from participants could be usefully applied in future communications.

The tone and the layout of the microsite, as well as the nature of the game, suggested that the websites was aimed at teenagers while the language was technical and the content difficult to understand. Some were confused.

> *"The website was very much targeted at teenagers. I found it off-putting and I'm actually interested."*
>
> (Reconvened)

> *"The website was good, everything was there, but because I didn't understand the terminology I was flicking back and forward and I lost the will to live, after a long day at work."*
>
> (Reconvened)

The interactive games and videos were found to be very appealing when participants tried them. Users appreciated the fact that the information was simplified and easy to digest – the glossary was a good example. Lay summaries were appreciated in science websites in general.

Participants also liked the engaging graphics and colourful layout, and found the site easy to navigate.

> *"The website was easy to navigate as I found everything with relative ease. This, matched with the informative, colourful set-out of the website, makes it enjoyable to be on."*
>
> (Homework)

6.3. Consultation

Researchers at Babraham expressed concerns at the Researcher Day about how far the public could actually be **consulted** meaningfully on strategic issues.

> *"It is hard to see how the public could be of any help, as scientists have a very specific knowledge."*
>
> (Scientist, Researcher Day)

Some expressed the concern that, in order for the public to be helpfully involved in strategy setting, they need to have a good grasp of the difference Institute Strategic Programmes (ISPs) – but this knowledge was perceived to be quite difficult to convey.

> *"We want the public to understand what happens– you need to cover all the areas of research and it's very difficult."*
>
> (Scientist, Researcher Day)

Participants in the dialogue had the same concerns themselves; they knew that their scientific knowledge was limited, and that they did not really appreciate the subtleties of the different strategic programmes. The more they learned, the more they appreciated the limits of their knowledge. Nevertheless there was a strong desire for a **two-way conversation**; scientists communicating information about bioscience and the work of the Institute to the public, but also the **public feeding back to the scientists,** so that they could take on board a lay perspective.

> *"Public engagement is like a feedback system. It's knowledge that's being shared. It's like having a conversation. You're all going to learn something when you have a conversation."*
>
> (Reconvened)

> *"It's almost obvious from this group [that the public should be involved in strategy discussions] because people have different opinions and ideas."*
>
> (Reconvened)

Participants felt that while the public could not necessarily help with the specific details of research questions, they might be able to help with wider questions about research implications or ethical quandaries.

This could be in the form of the public posing questions to scientists, the questions revealing their perspective and the way they see the issues, rather than giving scientists 'information' as such.

> *"Direct dialogue is asking questions directly."*
>
> (Reconvened)

Participants suggested that public questions or input could trigger a new way of thinking for a scientist.

> *"Amateur astronomists have discovered planets so the public could help too."*
>
> (Reconvened)
>
> *"Scientists can't know everything can they? A member of the public could trigger something."*
>
> (Reconvened)
>
> *"Involving the public could be helpful because as a scientist you could be so focused on one goal but if you go out and communicate with other people it could help."*
>
> (Reconvened)

The **case studies** and scientific issues that participants remembered tended to be those with which they could make a personal connection. For example, those who had experience of long term conditions such as osteoporosis were interested in the issues discussed around healthy ageing and illness. Those who had children found the case study on epigenetics stuck in their mind, as it had implications for how they raise their children.

> *"When it comes to the PI3K family, if a baby is born early do they lack this and so are more prone to illness? My daughter was born early and gets ill."*
>
> (Cambridge)
>
> *"Being a non-scientist, the last meeting we had was such an eye opener. Because it's about the research that goes on here that can help me and the problems I have and my friends and family have. I could talk about this science even though we're not scientists. We wouldn't have talked about this otherwise."*
>
> (Reconvened)

For this reason the Institute could frame issues for consultation in the context of human effects rather than in terms of molecular bioscience.

Participants recommended interactive connections with scientists from Babraham, such as public debates and exhibitions, Q&As sessions around specific projects; or online forums around specific scientific ideas.

6.4. Participation

Participants liked the idea of participating through what they described as 'collaboration'. In Event 2, participants were asked which areas might be the best suited for further public dialogue activities on a strategic level. They said they felt that more specific areas might enable them to become informed enough to give a helpful view on strategy, for example:

- Disease driven vs fundamental research approaches – the benefits and drawbacks of each to publicly-funded research
- Should scientists consider ethical questions and what happens if they don't?
- How the public can themselves be involved in basic bioscience; for example running citizen science projects, donating tissues or genome profiling to contribute to population studies.

Participants recognised that the Institute does not have unlimited resources to engage the public, or indeed to discuss ethical questions with other scientists or experts, but felt that some provision should be made. In fact, they felt it was very important for the credibility of public engagement to see scientists actively making contact with the public in strategy-focused discussions.

While some participants expressed the concern that taxpayers cannot influence the way public funding is decided and allocated, some others more optimistically thought that the public could have a role in influencing public funding decisions, if they were involved in decision-making.

> *"The benefits of public engagement would be getting more support, appreciation for what scientists do. This might mean the public put more pressure on for more funding."*
>
> (Reconvened)

In general, participants felt that the Institute needs to be transparent about how taxpayers' money is used and where possible to invite discussion on strategy. The more power the lay public have to influence decision making, and the more the Institute can demonstrate that the public are listened to, the more accountable the Institute will appear for the way it spends public funds.

> *"At the end of the day we are the tax payer... I'd rather know where my money goes to and then take a decision. We should be the ones deciding where the money goes."*
>
> (Reconvened)

> *"If it's being funded by the general public, then it's not unreasonable for the public to make sure it's getting what it wants."*
>
> (Reconvened)

7. Considerations for the future

What this chapter contains

This chapter presents brief reflections on the process and findings, and some questions to consider.

7.1. Revisiting the objectives of the dialogue

Objective 1. **To engage in dialogue with civil society and other stakeholders and a balanced recruited sample of lay public about the challenges and big questions relevant to the Babraham Institute**

- The dialogue covered a wide range of stakeholders and a balanced sample of lay public. Attendance was good and participants engaged with the discussion on challenges and big questions.
- The process revealed that it is a challenge to formulate materials and structure questions on the strategic issues as a whole facing the Institute.
- The most engaging part of the dialogue day for participants was to have the scientists present to explain their work and engage in dialogue. This suggests that bringing public and scientists together again in future as often as possible, will be a good way to help the public appreciate the key challenges facing the Institute.
- Could future engagement be shaped in the light of knowledge from this dialogue about the lay public's views towards ageing, low levels of knowledge of bioscience, and interest in personal and human-level narratives?

Objective 2. **To gain insight and understanding from the public and civil society that will inform and influence both scientific (objective 2a) and public engagement (objective 2b) strategies.**

- The findings suggest that there are some clear public priorities for science strategy. How can the Institute take account of these in its decision making (for example the need to consider downstream implications of basic bioscience, when these might not be clear)?
- Participants found it hard to conceptualise the differences between the different ISPs. How important is it to gather public views on science strategy at an ISP level?
- Participants wanted Babraham to demonstrate that it is taking account of wider society in the way in which is makes decisions about the public interest of its research. How can this be achieved?
- Participants want Babraham to communicate its work but also to allow a more informed public to have some decision-making influence, even if only to demonstrate that the Institute is accountable for how it spends public funds. How can this be achieved?
- The findings of this dialogue suggest it would be of interest to the public if the Institute committed to 'public collaboration' as well as 'engagement'. It may be an interesting experiment to at least talk within the Institute about what this term might mean to Babraham. How could public 'collaboration' be achieved within the Institute?

Objective 3. **To raise awareness and highlight the importance of the Institute and its science with stakeholders and** ***Objective 4.*** **To gain an understanding of how the public and stakeholders view our work**

- Stakeholder and general public participants in this dialogue certainly felt that their awareness had been raised. However, the dialogue process as a whole was relatively resource-intensive for the Institute. How can awareness-raising and two-way engagement be continued, and what resource-effective ways are there to do it? Is there scope for online or other methods to reach out to a wider stakeholder group? Can the participants of this dialogue be engaged again?

Objective 5. **To demonstrate best practice in openness/responsiveness and social responsibility.**

- The value of the dialogue is ultimately in its impact upon internal practice. Which mechanisms within the Institute can link public and stakeholder views back to research and engagement strategy?
- At the Researcher Days, the researchers also asked the question - In whose interests is the dialogue being run? How can the findings be used to help the research team? The Management Team of the Institute will need to consider how the findings will be implemented internally.

Appendix A - Who was involved in the project

Table 1: Public Dialogue project team

Organisation	Name	Title
BBSRC	Dr. Patrick Middleton	Head of Engagement
Sciencewise	Daniel Start	Dialogue and Engagement Specialist
Babraham Institute	Prof. Michael Wakelam	Director
Babraham Institute	Dr. Geoff Butcher	Head of Campus Capability Grant
Babraham Institute	Dr. Simon Cook	Head of Knowledge Exchange and Commercialisation
Babraham Institute	Dr. Len Stephens	Head of Signalling ISP
Babraham Institute	Dr. Martin Turner	Head of Lymphocyte Signalling and Development ISP
Babraham Institute	Prof. Wolf Reik	Head of Epigenetics ISP
Babraham Institute	Dr. Peter Fraser	Head of Nuclear Dynamics ISP
Babraham Institute	Dr. Anne Corcoran	Nuclear Dynamics ISP
Babraham Institute	Dr. Gavin Kelsey	Epigenetics ISP
Babraham Institute	Dr. Cheryl Smyth	International Grants manager
Babraham Institute	Dr. Danielle Hoyle	Grants Manager
Babraham Institute	Dr. Louisa Wood	Communications Manager
Babraham Institute	Linden Fradet	Knowledge Exchange Manager

Table 2: Babraham Institute's scientists who participated in the "Researcher day"

ISP	Name	Title
Signalling	Katherine Fletcher	PhD Student
	Dr Simon Rudge	Senior Researcher
	Stacey Gould	PhD Student
	Martin Baker	PhD Student
	Barzan Sadiq	PhD Student
Immunology	Dr Marc Veldohoen	Group Leader
	Dr. Geoff Butcher	Head of National Capability Grant
	Dr. Michelle Linterman	Group Leader
	Becky Newman	PhD Student
	Amy McQueen	PhD Student
	Dr. Fabien Garcon	Post doc
	Dr. Priya Schoenfelder	Post Doc
	Dr. Helena Ahlfors	Post Doc
Nuclear Dynamics	Dr. Mikhail Spivakov	Group Leader
	Dr. Sarah Elderkin	Group Leader
	Dr. Karen Lipkow	Group Leader
	Dr. Patrick Varga-Weisz	Group Leader
	Jo Mitchelmore	PhD Student
	Dr. Paula Freire-Pritchett	Post doc
	Dr. Hashem Koohy	Senior Researcher
	Ola Mielczarek	PhD Student
	Dr. Sven Sewitz	Senior Researcher
Epigenetics	Dr. Myriam Hemberger	Group Leader
	Melanie Eckersley-Maslin	PhD student
	Dr. Gavin Kelsey	Group Leader
	Dr. Jon Houseley	Group Leader
	Steven Frenk	PhD Student
	Dr Natalie Rynkiewicz	Post doc
Facility/Science support	Simon Jones	Director of Operations
	Dr. Hanekke Okkenhaug	Imaging Researcher
	Dr. Colin Gilbert (VET)	Site Vet
	Bhupinder Virk	Bioinformatics Researcher
	Dr. Tacita Nye	KEC Officer
	Michael Hinton	KEC Officer

Table 3: Advisory Group members

Organisation	Name
BBSRC	Dr. Patrick Middleton
Sciencewise	Daniel Start
Centre for Science and Policy	Dr. Robert Doubleday
British Society for Research into Ageing/Cardiff University	Prof. David Kipling
CASE / UCL	Prof. Graeme Reid
Cardiff University	Prof. Joanna Latimer
London School of Economics	Dr. Carrie Friese
Nuffield Council for Bioethics	Dr. Peter Mills

Table 4: External stakeholders who contributed to development of dialogue materials

Category	Organisation	Name	Contribution
Research bodies / funders	Worldwide Cancer Research	Prof. Christine Watson	Attended meeting
	MRC	Sharmila Nebhrajani	Interviewed over the phone
Trust and Foundations	Wellcome Trust	Dr. Natalie Banner	Attended meeting
Civil society groups / charities	British Society of Immunology	Dr.Jennie Evans	Attended meeting
	Understanding Animal Research	Dr. Bella Williams	Attended meeting
	Centre for Ageing Better	Thomas Rintoul	Attended meeting
Academic institutes	Cambridge Enterprise	Dr. Iain Thomas	Attended meeting
	Stem Cell Institute	Dr. David Kent	Interviewed over the phone
	Stem Cell Institute	Philippa Russell	Attended meeting
Public bodies	Research Councils UK	Dr. Sushma Tiwari	Attended meeting
Industry reps	GSK	James Anderson	Interviewed over the phone
Media	ITV News	Dr. Lawrence McGinty	Interviewed over the phone
Professional bodies	The British Geriatrics Society	Prof. Gordon Wilcock	Interviewed over the phone
Clinicians	Cambridge Cancer Centre	Dr.Kenneth Seamon	Interviewed over the phone

Table 5: Babraham Institute's scientists who participated in the public dialogue workshops

ISP	Name	Title	First event	Reconvened event
Nuclear Dynamics	Dr Peter Fraser	Head of Laboratory		X
	Katherine Fletcher	PhD Student		X
	Dr Hashem Koohy	Senior Researcher	X (Birmingham)	
	Dr Karen Lipkow	Group Leader	X (Birmingham)	
	Dr Sven Sewitz	Senior Researcher	X (Cambridge)	X
Epigenetics	Stephen Frenck	PhD Student	X (Birmingham)	
	Dr Gavin Kelsey	Group Leader		X
	Prof. Wolf Reik	ISP Lead	X (Cambridge)	
	Dr Natalie Rynkiewicz	Post doc	X (Cambridge)	
	Dr Fatima Santos	Senior Researcher	X (Cambridge)	X
Signalling	Martin Baker	PhD Student	X (Birmingham)	
	Dr Simon Rudge	Senior Researcher	X (Cambridge)	X
Immunology	Becky Newman	PhD Student	X (Cambridge)	
	Dr Marc Veldhoen	Group Leader	X (Cambridge)	X

Table 6: Detailed breakdown of participants' profile

First event: Birmingham (18 participants)

Gender	Male	10
	Female	8
Age	16-24	3
	25-44	6
	45-64	8
	65+	1
Working status	Employed	17
	Unemployed	1
Ethnicity	BME	5
	Non-BME	13
SEG	A, B, C1	11
	C2, D, E	7

First event: Cambridge (25 participants)

Gender	Male	10
	Female	15
Age	16-24	5
	25-44	12
	45-64	6
	65+	2
Working status	Employed	15
	Unemployed	10
Ethnicity	BME	2
	Non-BME	23
SEG	A, B, C1	13
	C2, D, E	12

Reconvened event (41 participants)

Original location	Birmingham	16
	Cambridge	25
Gender	Male	18
	Female	23
Age	16-24	8
	25-44	16
	45-64	14
	65+	3
Working status	Employed	30
	Unemployed	11
Ethnicity	BME	7
	Non-BME	34
SEG	A, B, C1	24
	C2, D, E	17

Appendix B - Event 1 discussion guide

Timing	Session & objectives	Questions
10.30-10.55	**Introduction to the day**	*PARTICIPANTS COMPLETE QUIZ AS THEY ARRIVE IN PAIRS OR TEAMS IF THEY LIKE* **PLENARY** • Introduction to facilitators and observers • Introduction to scientists and other participants • Hello from evaluator **TABLES** • Introduction to each other • Warm up: When you think of a typical scientist, what do you think of? Look, age, gender, what do they do all day? • What different types of scientists do you know about? (e.g. different areas of specialisation, any sense of fundamental vs applied) **PLENARY** • Questions about Babraham and the project / process • Any questions about Babraham's work e.g. comprehension of fundamental research
10.55-11.30	**Ageing, maintaining health and the quiz results** Collecting spontaneous views and drip-feeding info about fundamental bioscience	**TABLES** The key question of today is *How can Babraham's fundamental bioscience help people live long and healthy lives?* (also written up on boards around room). As we have just heard, this work fits in with the aim from BBSRC to look at healthy ageing and maintaining health. So we will start by talking about these ideas a little before hearing more about Babraham's science. **Ageing & health** *FACILITATOR COLLECTS THOUGHTS ON FLIP CHART* • What do you think of when we say ageing? ○ Probe on when does it start, physical, emotional, social dimensions, what is an old person • What's hard / easy / positive/ negative about it for you / people you know • What's an essential part of ageing and what isn't (probe on thoughts about frailty, resistance to disease, weakness, isolation?) • What is ageing well? How important is it to live long, and what are the components of a good old age/ long life / even a good death? • How important is ageing as a health issue? What others issues are important? • How is ageing different for us from how it was for our grandparents? What will it be like for us/our children? • Maintaining health – what does this mean in context of ageing?

		• How do you think scientists can help people lead long and healthy lives? • How can people themselves help to lead long and healthy lives? • If science could do one thing to help us have lifelong health and wellbeing, what would you want? *NOTE TO THE INTERVIEWER? AIM IS TO HEAR ABOUT ANY RESEARCH AREAS WHICH ARE SPONTANEOUSLY CONSIDERED TO BE IMPORTANT – TABLE COLLECTS ONE OR TWO BETWEEN THEM* **PLENARY** **Quiz results** • Share thoughts from each table on the one thing they want • Results of quiz presented on projector & brief discussion • Questions about anything; were you surprised by any answers? **Babraham and ageing :** *Spontaneous thoughts* • Ageing in a biological sense starts early in life – does this affect the way scientists should consider ageing? • When scientists research ageing, they may be thinking about it on every level from the molecular to the wider social issues. • Babraham is a fundamental bioscience institute, so what kinds of issues should they be thinking about when it comes to ageing? • Is this different from how you would consider ageing? How? • Which areas could Babraham research which would be most valuable to society, relating back to the issues you thought were most important when it comes to ageing?
11.30-11.50	**Scientists introduction**	**TABLES** **Talking to scientists about their own work** • Babraham scientists do what you might call “curiosity driven science” – what kinds of work does that suggest to you? • What is the value of this kind of science? Consider the idea that benefits are not predictable and may take a long time to develop into products; what is the value of the knowledge for its own sake? To whom? • Scientists describe their current work and their own career path so far - general conversation and general questions from public (likely to be about purpose of research, personal drive to become a scientist, aspirations for future)
11.50–12.30	**Case studies**	**TABLES** **Case Studies** Facilitator to present, read out case study, each participant has a pack with the case studies in – they can write on /amend them. **For each case study:** • What seems appealing, interesting? • Anything confusing? • Any concerns? • How valuable would you perceive this work to be – to you, to society as a

		whole? *Alternative - Why does it matter, and to who?*
		• Looking at the research questions:
		  ○ Which of these questions seem most interesting, relevant, useful?
		  ○ Who would this work benefit?
		  ○ How could this science be put to use in the way that would do the most good?
		  ○ How might this contribute to maintaining health and wellbeing?
		
		Specific questions for each case study
		
		Chemical switch / pi3ks:
		• *NB – LOTS OF THE NEXT PROJECTS WE WILL SHOW YOU DRAW ON THIS FUNDAMENTAL UNDERSTANDING OF PI3KS*
		• This area of research underpins a lot of what Babraham does. How valuable is it to invest in curiosity driven research into how our cells work and signal to each other?
		• How do we balance the need for 'outputs' with the need to allow scientists to follow their curiosity?
		• Is this more valuable to you than, for example, looking at downstream development of medicine? For example the research councils' budget could focus on how existing medicines could be applied to new conditions rather than on this kind of wide ranging curiosity driven research.
		• What is the value of this research; to you, as a taxpayer, citizen, patient, individual?
		
		Cell recycling / autophagy:
		• Which of the areas of autophagy research are you most interested in?
		• How important is it to manipulate our lifespan?
		• Should we be investing in ways to do this 'in the lab' or simply encouraging people to adopt healthy lives based on what we already know about health? *[NB: FACILITATOR CAN THEN POINT OUT THIS IS ALSO BASED ON PRIOR SCIENCE KNOWLEDGE!]*
		
		Vectibix:
		- This is based on long-term research which takes a very long time to get out into a commercial product. How valuable is it to carry out research like this over the long term – given that we may not know what the outcomes will be?
		- The average length of time it takes to get translate a piece of fundamental scientific research into a licensed drug is almost 20 years. Should pharma be paying for the fundamental research, or later stages?
		- Role of animals: may need to discuss at this point. How acceptable do you find the use of mice in this sort of fundamental research (*NB NOT DRUGS TESTING BUT CREATING /BREEDING MICE THAT CAN PRODUCE THESE ANTIBODIES)*
		
		Summary
		• <u>Overall</u>, before lunch, what is the most interesting thing you have seen so far?
		• Which has the most 'value'? *NB HOWEVER YOU ARE DEFINING VALUE*
		• Which has most/least applications, which seem most near/long term in benefit, who benefit? *FACILITATOR TO TEASE OUT PRINCIPLES UNDERLYING WHAT THEY SAY. WHAT VALUE DO THEY PLACE ON CURIOSITY DRIVEN RESEARCH?*

12.30 – 1.15 **LUNCH**		
1.15-1.45	**Finish case studies 1-6**	**TABLES** **Specific questions for each case study** *Train the body to kill cancer*: • This may have a commercial application; how valuable is it to do strategic research for specific conditions, based on fundamental research? • Should Babraham be doing this type of research or 'leaving it' to Cancer charities/commercial companies? • How interested are you in the personalised medicine implication? What could that change about our medical system, our expectations, our society? • We may need to know a lot about our genomic data to deliver personalised medicine. Does this raise issues of privacy? • Ethics - what's fair in terms of treatments – if we know a treatment can help one kind of person but not another, should we give the person who we know we can help the treatment even if it means we cannot help other people? • Should Babraham scientists be thinking about how their work plays into diagnostics as well as biomedicine? • How acceptable do you find the use of mice in this work? *What do genes really look like:* watch https://www.youtube.com/watch?v=TyzS6sC1KYc • This is a very fundamental research project; how important do you find it as compared to more strategic or downstream projects? What is the value of it? Who should be funding it? • There is well known fundamental research in other areas – e.g. looking at Mars, Higgs-Boson etc – how does this compare in relevance, importance, interest to you? *Why don't vaccines work so well for older people:* • How important is this area of research for improving lifelong health? • Give details on the breakthrough assay process (see slide) – what is the value of developing new processes by which fundamental bioscience can be done more quickly and easily?
1.45 – 2.30	**Epigenetics primer and discussion – then final case studies 7-8**	**PLENARY – then discuss on TABLES** *CAN SHOW YOUTUBE & BACKGROUND EPIGENETICS HANDOUT* • Comprehension – questions **Specific questions for each case study** *How could our diet affect our grandchildren:* • Is diet more / less 'worthwhile' than other areas of research? E.g. we already know quite a lot about healthy diets, what is the value of this area of research? (as taxpayer, individual, etc) • How important is it to understand how the environment affects our cells and bodies? • Ethical context of epigenetics. Maybe in future we will be able to engineer better 'epigenomes'. Should we? • What are the implications? • Do people have a 'responsibility' to their children and children's children to

		build the best epigenome they can? • What should Babraham's position be on this? • How acceptable do you find the work with mice in this context? *Looking at the way our cells age through yeast*: • Views on reducing animal research? • Yeast DNA has been mapped and sequenced and is well understood. Using yeast cannot replace animal research but it can reduce the need for it. Yeast is stable and easy to grow in the lab. It has many genes that are the same as human genes, so it is considered a good model for human cells in fundamental research. • How important is it to understand the mechanism of ageing in this way? • Should we seek to alter natural ageing processes? • How does this definition of ageing – relating to the epigenetic aspects of the cell – fit with what you think of as ageing? • Does it alter any of the thoughts you had earlier today about the role of science in helping us age well? *SUMMARISE ALL CASE STUDIES ON TABLES – IF TIME:* • Most interested in • Most valuable for Babraham to investigate further • Most useful to society when it comes to helping us maintain health and age well
2.30 – 2.50	**Animals in research**	**TABLES** • First thoughts, opinions, concerns about the use of animals in research • How acceptable is it for you – what conditions would you place on the use of animals in scientific research? • Reading the first animal handout: anything unexpected that you didn't know *(REITERATE THINGS LIKE COSMETIC TESTING NOT ALLOWED, GENETIC MODIFIED ANIMALS USED AS MODELS AND V UNLIKELY TO 'ESCAPE FROM THE LAB' IF THESE ISSUES COME UP)* • Reading the second animal handout: Types of research done at Babraham: broadly how acceptable do you find each of these four? • On what does this view depend? How would you rank the acceptability of the 4 types of research here *(NB DISCUSSING IN TERMS OF HEARING THEIR ARGUMENTS RATHER THAN TO COME TO A CONCLUSION)* • How valuable are the benefits of animal research in these examples? • What more would you like to know about the research, process, numbers, purposes…? • Babraham is committed to openness in Animal Research - mention Concordat. How important is it for the Babraham 'swork to be open, and what does openness mean for Babraham? • Some ideas about the 3Rs; is it more important for Babraham to complete their research priorities or for them to do research which tests out how best to reduce number/sentience of animal models? Is this a trade off, and if so, is it one worth making? • How should Babraham scientists consider the balance between risk of harm to animal and chance of discovery of something important – in the context of fundamental science *(I.E. WE CAN'T USE THE 'CURE FOR CANCER' ARGUMENT)*

2.50- 3.10 Small break		
3.10-3.45	**Priorities and principles**	**PAIRS** **Ranking exercise** *IN PAIRS ON TABLES: PLEASE RANK ALL THE CASE STUDIES IN TERMS OF WHICH IS MOST VALUABLE TO YOU - WE DIVIDE THE GROUPS SO THAT DIFFERENT TEAMS ARE LOOKING AT DIFFERENT WAYS OF RANKING:* • Which is of most value to you as an individual • Which is most value to the taxpayer funding this kind of research • Which is best in terms of science to help people lead long and healthy lives **EACH PAIR PRESENTS BACK TO PLENARY** **TABLES** **Priorities and principles** • Using flip charts, come up with the top 3 priorities for Babraham work in future • How should they help meet the challenges of ageing and maintaining health? • What should they not do? • What advice should they take, and from who? • How will they know if they have got it right? • Plus – what should we cover in the next event? Questions for scientists – areas to discuss?
3.45-4.00	**Winding up**	**PLENARY** • Each table presents back • Homework task given out • Evaluation questionnaire • Reminder about logistics for next event • Thanks to all

Appendix C - Event 2 discussion guide

Timing	Session & objectives	Questions
12 – 12.20 pm	**Introduction to the day,** Take people to the room and allocate them to their tables	**PLENARY** • Introduction to facilitators and observers – each room has a led and second facilitator • Quick introduction to scientists and other participants • Hello from evaluators
12.20– 12.55pm	**Meeting each other and the scientists** Warm up participants and introduce scientists. Help participants understand life of a scientist – and to some extent, how the Babraham Institute makes decisions about project funding and how individual scientists form part of the picture.	**ROOM PLENARY (I.E. TWO SESSIONS, ONE IN EACH ROOM)** *LEAD FACILITATOR RECAPS OBJECTIVES OF THE DAY AND STRUCTURE, TAKES ANY QUESTIONS, THEN PASSES OVER TO TABLE DISCUSSION* **TABLES (I.E. 4 TABLES, 2 IN EACH ROOM)**: *IN PAIRS, PARTICIPANTS FROM DIFFERENT LOCATIONS MEET EACH OTHER THEN GO ROUND THEIR TABLE AND EACH PAIR SAYS HELLO / SUMMARISES* • Introduction to each other • Tell each other one thing you remember from last time – or something interesting you found out in your homework • Facilitator collects up homework *FACILITATOR INTRODUCES THE SCIENTISTS. (MIX OF DIFFERENT SCIENTISTS AND PARTICIPATING SCIENTISTS FROM PREVIOUS EVENTS).* • What are your career aspirations? • Where are the key points in their career choices (in the past and in the future)? • What are your day-to-day challenges? • What brought you to the Babraham Institute? • Are there any factors that affect your career aspirations? • To both scientists and the public: how do you think the public can best help X (this scientist) do work which benefits society?
12.55 - 1.40pm	**Scientific strategy: BABRAHAM looks to the future** Recap what we discussed at the first workshop Design ideas / principles for	**ROOM PLENARY** *PRESENT INTRO SLIDE RECAPS* BABRAHAM*'S MISSION, RECAPS THE CASE STUDIES EXPLAINS / REMINDS THAT THEY REFLECT 4 ISPS, PLUS SUMMARY OF PRINCIPLES EMERGING FROM FIRST WORKSHOP.* • Any questions on the Babraham Institute, the objectives of today? **TABLES - TWO MINI GROUPS AT EACH TABLE**In mini groups at each table we want you to discuss: • We would like you to think about what you said was important, in your 'principles' handout that you have for each team. Which of these principles do you think is most important and why? Principles handout

	future strategy	• Imagine you are in charge of Babraham and write a mission statement for the Babraham Institute. This is two or three sentences describing what Babraham will do in future and what will be its top priorities in the science it does. It starts "We will…" Be as clear as you can and try and include the important principles. What should matter to the Babraham Institute when deciding what to prioritise in the next 5 years? Key words on 'what matters' handout; 1 blank card handout • You have with you a handout of the case studies we discussed last time. We would like look again at the case studies we discussed last time and remind yourselves of the kind of work the Institute does. Which of the case studies do you think best reflect the mission statement you've written? Case studies handout **TABLES** **Teams present back to their table** • What should matter to Babraham when deciding which scientific areas to prioritise? • Where should resources be focused? In which area of science? Why? • How should Babraham make decisions on the types of researchers and projects it develops? What types of scientists should it look to hire? • Whose views should it take into account when deciding which areas to focus on / to fund? • Which case study is a good example of something that meets these criteria? Which would be a less good example? **General discussion** • Any common themes within the group? • In the light of this, should scientists at Babraham get given 'carte blanche' to do early stage research or should Babraham focus attention on specific areas? (e.g. making money? Or doing NON commercial work?) How can Babraham be sure that scientists will do research which meets these 'what matters' objectives?
1.40–2.20pm	**Quick recap then Coffee break**	*IN MAIN FOOD ROOM – THE TOP IDEAS FROM EACH TABLE IN EACH ROOM ARE SHARED, THEN PARTICIPANTS BREAK FOR COFFEE*
2.20 – 2.40pm	**Funding of basic research** Test how far contextual info affects perception of Babraham 's strategic decisions Refine ideas / principles for future strategy	**ROOM PLENARY** **Present funding slides.** • Any surprises – is this what you expected? • What implications for the strategy – would you change your mission statement, knowing where the funds come from, how much there are? • Given that there is not (and not likely to be in the next 5 years) a very large amount of public funding for basic bioscience, how can Babraham be sure it is using funds wisely? What single idea/ theme is the most important to prioritise, if you had to?

2.40 – 3.25 pm	**Animals in research** Identify how the Babraham Institute can be open, transparent, ethical and forward thinking in the way it uses animals. Assess how to communicate most effectively how Babraham uses animals in its research.	**TABLES** *FACILITATOR EXPLAINS THAT LIKE MANY LIFE SCIENCES INSTITUTES, BABRAHAM USES ANIMALS IN RESEARCH.* **Presentation and discussion** • First thoughts, opinions, concerns about the use of animals in research. • How acceptable is animal research for you – what conditions would you place on the use of animals in scientific research? What doesn't make it acceptable to you? **Presentation and discussion** • Types of research done at Babraham : - Broadly how acceptable do you find each of these four? - On what does this view depend? - How would you rank the acceptability of the 4 types of research here (NB discussing in terms of hearing their arguments rather than to come to a conclusion) **General discussion** • How valuable are the benefits of animal research in these examples? How useful to Babraham ? • How important is it that Babraham is transparent about the use of animals? What would openness and transparency look like? • How about the opportunity cost of being transparent – is it more important to be open, or to put those resources into the research? • How would you like to find out about animal research at Babraham ? • Explain the 3Rs; they set out some priorities for people doing animal research. What happens if Babraham 's research priorities conflict with these; for instance, is it more important for Babraham to use their resources to complete their research priorities or for them to do research which tests out how best to reduce number/sentience of animal models? Is this a trade off, and if so, is it one worth making? • How should Babraham scientists consider the balance between risk of harm to animals and the potential for discovery something important – given that they are doing fundamental science (i.e. we can't use the 'cure for cancer' argument) • Babraham has a tradition of expertise in exploring genetics of the mouse; how important it is to do mouse research e.g. with ageing mice here rather than elsewhere? **ROOM PLENARY** *EACH TABLE SUMMARISES TO THE OTHER THEIR VIEWS ON THE LAST 2 POINTS*
3.25-4.20	**Public involvement: the spectrum from engagement to collaboration** Discuss expectations	**TABLES** *TEST SPONTANEOUS VIEWS ON PUBLIC INVOLVEMENT – NO INFORMATION ON PUBLIC INVOLVEMENT IS GIVEN. WE ARE PROBING ON TWO DIFFERENT THINGS HERE: COLLABORATION AND PUBIC ENGAGEMENT. BABRAHAM COLLABORATION IS WITH ALL SORTS OF GROUPS MOSTLY OTHER SCIENTISTS AND POLICY MAKERS AND INDUSTRY – PUBLIC IS NOT REALLY COLLABORATION ITS PUBLIC ENGAGEMENT. PUBLIC ENGAGEMENT IS INVOLVING THE PUBLIC IN (1) HELPING FRAME BABRAHAM 'S STRATEGY; (2) INFORM THEM ABOUT*

	of public engagement to feed into strategy	*WHAT BABRAHAM DOES.* • What do you think of when you hear about the Babraham collaborating with either with scientists or other groups? • What different ways are there for Babraham scientists to collaborate with different audiences? Probe on levels of impact, decision making power vs being informed, etc • How about public involvement with science? Engagement with science? • Opportunity cost again: how far should Babraham prioritise doing things like this, against spending time and money on their research instead? • What's the purpose of Babraham engaging / interacting with the public? (e.g. to inform the public about the benefits of science so that voters can support public money going to science; to find out what areas of science are important to the public; to improve quality of research; to increase profile to minimise the risk of the public to complain about Babraham's research) • Why would scientists do it? (e.g. to inform the public about the benefits of science so that voters can support public money going to science; to find out what areas of science are important to the public; to improve quality of research; to increase profile; to minimise the risk of the public to complain about Babraham's research) • Why would the public (you) want to be involved? (e.g. to learn more? Is that up to scientists or up to you?) • What's the ideal outcome of engaging with the public for Babraham ? (e.g. to do better research, to capture public ideas about what's important, to hear how to communicate…) • What do scientists get from it? (e.g. to do better research, to capture public ideas about what's important, to hear how to communicate…) • And what do you get from it? (e.g. to give your views on risky or new technologies, to learn about what's changing…) • What do you imagine the Babraham Institute does already? • What do you think it should do more of? **TABLES** *FACILITATOR EXPLAINS THE TABLE EXERCISE. PARTICIPANTS NEED TO USE THE CARDS PROVIDED (WITH DIFFERENT TYPES OF PUBLIC ENGAGEMENT). FACILITATOR ASKS EACH TABLE TO POSITION CARDS ON THE TABLES (ON A SPECTRUM) ACCORDING TO SOME KEY METRIC. EACH FACILITATOR WILL HAVE TO CHOOSE THE KEY METRICS FOR ITS TABLE, DEPENDING ON THE PREVIOUS DISCUSSION. METRICS WHICH CAN BE USED ARE:* • for me / not for me • most / less useful to get the public to collaborate with Babraham • most / less interested in getting involved • most / less potential to give information *THE CARDS COVER THE FOLLOWING ACTIVITIES:* • Public debates

		• Making YouTube films • Preparing press releases to give to news teams • Holding public exhibitions • Presenting at science festivals • Running dialogues like this one • Interactive website run by Babraham • Games and apps about science • Animal research presentations • Visits to the Laboratory and the Animal unit • School visits by Babraham's scientists • On-line resources for schools • Science talks *AFTER THE EXERCISE, THE FACILITATOR STARTS THE TABLE DISCUSSION:* • How far should Babraham's scientists be involved in these activities – all of them? Only some? *[probe: only those who are good at it? Only those who are interested?]* • How often should these events be run? • Should non-scientists be involved? • What kinds of activities are missing? • How do you want to be involved by Babraham ? What do you want to hear from them? **TWO GROUPS ON EACH TABLE** • Choose a case study and come up with some ideas for how the public could be involved with the science behind it – be as creative as you like, money no object, but explain why doing this would be useful/important! **TABLES** • Please feed back to your table. What did you come up with? • Which activities could be developed? • Why did you choose that case study? • Why do you think the public would be interested in attending pubic engagement activities on this case study? • Why do you think it would be useful to get the public to collaborate with Babraham on this case study? • What are the opportunities to share more information on this case study? And how can this be done? **ROOM PLENARY** *FACILITATOR STICKS FLIPCHART ON WALL SHOWING MILESTONES IN THE RESEARCH PROCESS. THE FACILITATOR ASKS PARTICIPANT TO STICK POSTIT NOTES NEXT TO THE BOX WHERE THEY THINK THE PUBLIC SHOULD BE INVOLVED. PARTICIPANTS HAVE TWO COLOURS THEY CAN USE?* • *Yellow: to indicate activities where people should be involved sometimes* • *Pink: to indicate activities where people should be involved always*

		- Where in the research process should public engagement fit in? - Always / sometimes / never? - Why here? What would be the benefits brought to Babraham ? - And to the public?
4.15 – 4.30	**Wind up, evaluation, next steps** Wrap up	**PLENARY – one room joins the other** • Thank you • Next steps • Incentives • Evaluation questionnaire

Appendix D – Stimulus material

Important biological switch

Babraham scientists discovered an important "switch" in the 1980s.

The switch is found in every cell in our body – it's made from the 'PI3K' family of proteins.

These control how cells grow, how cells reproduce, what jobs are done by cells, and even how long cells live for. These things have a major effect on how healthy our bodies are, and how healthily our bodies age.

In many cancers, PI3K activity is abnormal.

People born with dysfunctional PI3K can be very prone to infections.

Babraham is one of the world's leading research centres for this switch, which has led to collaboration with pharmaceutical companies.

The research Babraham is doing into PI3K tries to understand its role in ageing, cancer, fighting disease and genetics.

Ultimately this work has led to the development of medicine to treat diseases.

Important biological switch

What Next?

Len Stephens
Group Leader, Head of Signalling Programme

Phill Hawkins
Group Leader

- Can understanding how PI3K works help us understand diseases?
- What do we need to know about how the whole family of PI3Ks work?
- How is PI3K related to how we age?
- How is PI3K related to how our immune system fights disease?
- Are these factors (ageing and the immune system) linked?

Cells can recycle themselves

Cells can eat-up and recycle old, unneeded or damaged chemicals (proteins) and cell parts. This process is found in all animals – so we know it must be important in biology.

If cells do more of this recycling process, it slows the ageing process in animals and they live longer.

The process is called Autophagy – which means "eating yourself."

One way to make your cells increase autophagy is by diet.

Severely restricting calories (by 30%) increases autophagy and extends lifespan in some animals (worms, dogs, rats) but not in others (wild mice). We do not know whether this effect would be seen in humans.

Babraham researchers are investigating the effects of a limited diet on autophagy. They use human kidney cells and have discovered that removing nutrients makes the autophagy process increase.

Cells can recycle themselves

What Next?

Simon Rudge, Senior Researcher

- If autophagy controls how long yeast or mouse cells live, does it do the same in humans?
- If so, could we control autophagy (through diet or other means) to manipulate our lifespan?
- Can we find out what role autophagy plays in cancers, Parkinson's, Alzheimer's, infectious diseases…?

Vectibix: an antibody to use against cancer

In 1975 scientists discovered they could make specific antibodies in laboratory mice. These were called monoclonal antibodies, and are a massive success as a laboratory tool.

They could not be used as a treatment for patients because the human immune system sees mice antibodies as 'foreign', and destroys them.

In the 1980's Babraham scientists created a mouse that could create 'humanised' monoclonal antibodies, which are less likely to be destroyed by a patient's immune system. The mouse was licensed to a company who used it to create an antibody to treat colorectal cancer – the drug Vectibix.

Since 2006 Vectibix has brought more than £10.6 Million to Babraham, which has been reinvested in Babraham's science.

Babraham also created Crescendo Biologics in 2007 to develop similar technology. This company has received over £24M investment, and is developing drugs for psoriasis and cancer.

Vectibix: an antibody to use against cancer

What Next?

Katy Evans-Roberts
Commercialisation Manager

- What is the next 'Vectibix'? What's the next discovery that can have a positive outcome on disease?
- How can curiosity driven research work best with pharmaceutical research?
- How and at what stage should we collaborate with commercial companies?

Can we train the body to kill cancer?

Did you know your immune system can fight cancer?

But sometimes harmful cancers can "hide" to look like normal cells, so the immune system does not attack them.

Babraham researchers are looking at the part that PI3Ks play in the process of killing cancer cells.

Using mice, Babraham researchers discovered that blocking PI3K activity can help reveal tumour cells that are "hiding" from the immune system, slowing tumour growth.

However, blocking the PI3Ks also had an unwanted effect. It could stop other immune system cells from killing cancer cells.

- This balance differs in different tumour types.
- This balance differs between individuals

So, scientists are trying to work out the best way to balance the positive and negative effects. They aim to create a way to encourage the body to kill the cancer cells itself.

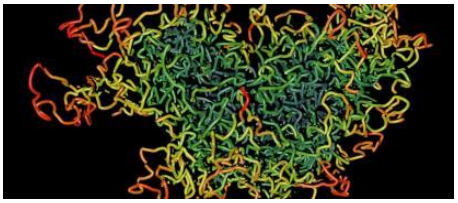
Can we train the body to kill cancer?

What Next?

- How to stop tumour cells from hiding so well?
- Can we develop personalised medicine so that cancer patients get the right 'cocktail' of immune therapies?

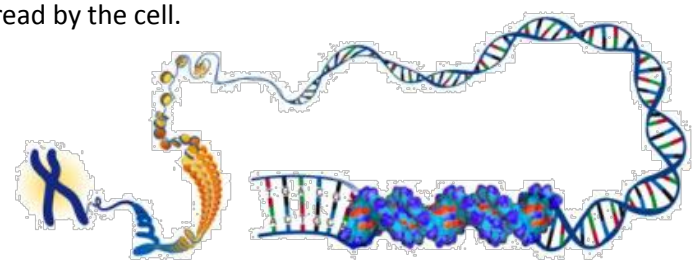
Ee Lyn Lim
PhD Student

What do chromosomes really look like?



Scientists at the Babraham Institute have produced 3D computer models that show, for the first time, the complex shape of chromosomes and the way DNA within them folds up.

This is important because the way DNA is packaged inside the nucleus has a big effect on controlling how our cells function. DNA is a recipe for making proteins. The way DNA is physically arranged determines whether the recipe can be read by the cell.



What do chromosomes really look like?

What Next?

Peter Fraser,
Group Leader

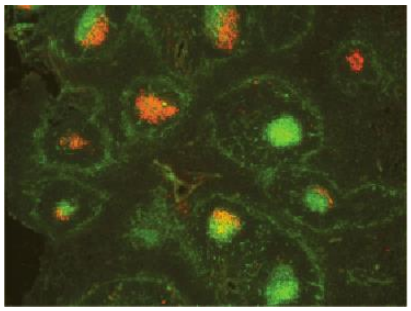
- Why does the location of chromosomes in three dimensions affect how well, or how much it can be read (i.e. activated)?
- How does this affect our health and the way we age?
- Are the effects of ageing caused by changes in the 3D organisation of genes?

Why don't vaccines work so well for older people?

Antibodies are proteins made by our immune system. They are made in response to infection and help our bodies attack and kill bacteria and viruses. Our cells can make a massive variety of antibodies by 'recombining' different building blocks into new antibodies.

Babraham scientists are investigating why older mice don't make as many, and as effective, antibodies as younger mice.

If there are parts of the antibody genes which are further away from the place where the 'recombining' happens, they don't get used – which leads to fewer antibodies, and a smaller variety.



This research could help us understand how to vaccinate older people to protect them from disease. Vaccinations rely on a good antibody response, and so vaccines tend to work less effectively in older people.

Why don't vaccines work so well for older people?

What Next?

Anne Corcoran
Group Leader

- What factors are causing some antibodies to be made less often by old mice than young mice?
- Why does age make a difference to the location of the antibody on the chromosome?
- How can we use this to help vaccinate older people?

Epigenetics – DNA is not your only destiny

For a long time scientists thought that the DNA in our cells, which makes up our genes, was fixed before birth and could not be changed.

We now know that though the DNA sequence doesn't change, what happens to the genes can be affected by things that happen to you in your life. Some changes can be caused by things in the environment (e.g. diet, or toxins).

This is the study of **epigenetics**.

'Epigenetic marks' are chemicals which 'stick' on to areas of DNA and affect the way the DNA in the cell organizes.

The way that DNA organizes is one of the major factors in whether it can be 'read' – whether it can 'be activated' and produce proteins.

When DNA is tagged epigenetically it becomes more or less open or tightly wound. If the tags loosen the tightness, DNA becomes more exposed so parts of it are more likely to be read.

Babraham scientists are trying to understand exactly how epigenetic markers control the gene.

Could our diet affect our grandchildren?

During WWII some Dutch babies were born small because their mothers did not have enough food in early pregnancy. They stayed smaller than average all their lives, even when food was plentiful- and so did their OWN children (the grandchildren).

Scientists did not understand why these changes in the grandparent's environment could have an effect down the generations. It is now thought that epigenetic changes make the difference.

Babraham scientists are exploring whether diet causes epigenetic changes. They give mice different kinds of diet. They then look at whether differences in diet mean that epigenetic changes are seen in the offspring.

Could our diet affect our grandchildren?

What Next?

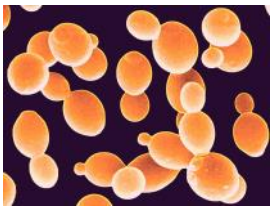
Fatima Santos
Senior Researcher

- What effects do pregnant mothers' diets have on their offspring?
- Can we, eventually, create a better 'epigenome' for people?

Looking at the way our cells age…by growing yeast

Babraham scientists are studying the DNA in yeast and looking at epigenetic changes. Yeast cells age each time they divide, and this ageing process means 'epigenetic marks' are created which affect the way the DNA in the cell organizes. This can change whether genes are read.

In their short lifetime, yeast cells divide around 30 times - similar to the number of times a human cell can divide in its lifetime. This makes them a good model for human cells.



Babraham scientists exposed yeast cells to a sudden environmental change. The old yeast cells responded much better to the change and dramatically outcompeted the young cells.

This Babraham research suggests that something about ageing may be beneficial for survival.

Looking at the way our cells age…by growing yeast

What Next?

Steven Frenk
PhD Student

- How did ageing evolve?
- Does ageing improve your ability to adapt to new environments?
- How does ageing actually work? Why does a mouse age in 2 years, but a whale in 200?
- We often assume that ageing is bad for you, but does ageing actually improve your ability to survive?

Animals in research in the UK

The UK has a tightly regulated policy on the use of animals in research.

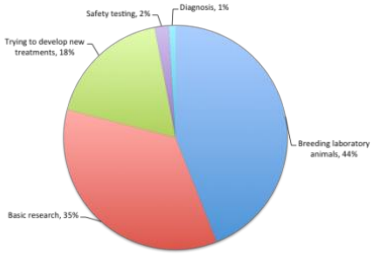
Vertebrates (animals with backbones - mammals, fish, reptiles and birds) are 'protected'.

Research which may cause harm is regulated and a Government licence is needed

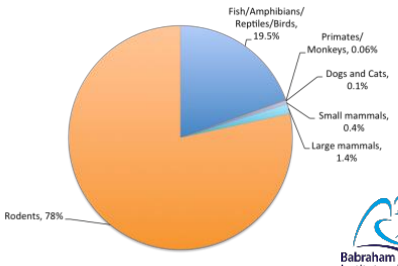
It is driven by the 3R's:

- **REPLACE** the use of animals with alternative techniques, or avoid the use of animals altogether
- **REFINE** the way experiments are carried out and the way animals are housed and cared for throughout the animal's experience, to make sure that suffering is minimised and animal welfare is improved
- **REDUCE** the number of animals used to the minimum necessary, so that the scientific question can be answered robustly, but using fewer animals or more information obtained from the same number of animals.

What kind of research is done?



What kind of animals?



How are animals used at Babraham?

- Transgenic mice have had extra genes inserted into them.

- Babraham scientists use some transgenic mice which have genes inserted that make cells glow under the microscope . This can show how their shape or position changes in ageing or disease.
- One way mice like these are used is to look at how proteins move inside healthy, diseased, injured and ageing nerves.
- Some of the mice are killed (humanely) so that their nerves can be observed under the microscope.

- Sometimes mice have gene function removed.

- This helps scientists see what happens to the mouse when the gene is not working.
- At Babraham, one research study uses mice like these. The mice are given chemotherapy drugs that sometimes cause painful side effects in human patients.
- Their behaviour is tested in two ways
  - Putting pressure on the paw
  - Putting the mouse on a cold plate
- The reactions of the mice reveals whether they are less sensitive to stimuli, and experience less pain, compared to mice that still have the gene
- The reason is to explore whether this could be a way of reducing pain for cancer patients who receive chemotherapy.

- Some mice are bred to simulate specific models of disease.

- At Babraham, one research project inserts tumour cells into mice and lets them grow for three weeks. The mice are then humanely killed and researchers are able to look at the cells in the tumour.
- They are looking at how the tumour cells have grown and how mouse immune cells, that have travelled to the tumour, are working against it.
- They are specifically looking to see whether drugs inhibiting an important enzyme can stop tumour growth and/or improve the immune response to the tumour.

- Some mice are allowed to grow old.

- Babraham has a colony of ageing mice.
- These are mice which are up to 24 months old (which is old for a mouse!).
- They are used, for example, in the study of antibodies to see how a mouse's production of antibodies changes as it grows older.

Appendix E – Homework task

Homework time!

Name_____

Surname_____

Location of event attended (circle as applicable): Birmingham/Cambridge

Homework	***Completed?***
Task 1: **Immune Army website** Take a look at www.immunearmy.babraham.ac.uk along with a friend or family member, then ask them… • What did they find most interesting? • What did they find difficult to understand? • What top questions would they have for Babraham Institute scientists?	Yes / No
Task 2: **How Science Can Help Ageing** Do some research elsewhere online. You can use a google search as a starting point. • Write down where you went and what you found • Come up with 3 ideas for how scientific advances might influence our lives – find the most interesting things you can!	Yes / No
Task 3: **Interview a friend** Interview a friend about their experience of ageing. • How do they define ageing? • What do they like about getting older? • What don't they like about getting older? • What do they wish was different about ageing?	Yes / No

Thank you!

Task 1: Immune Army website

- Step 1: find a friend or family member who you want to involve in this task – choose somebody you get along with, you have easy access to, and who will enjoy learning about the beauties of our immune system!
- Step 2: You and your friend / family member should take a look online to Babraham Institute Immune Army website: www.immunearmy.babraham.ac.uk
- Step 3: Now the fun part… Pretend to be working for Babraham Institute, and to be responsible for developing the content of the website. You want to figure out how clear and useful (if at all!) the website is. Interview the friend about their views on the website.

Please write your answers below….

What did you find most interesting? What did you find difficult to understand? What top questions would you have for Babraham Institute scientists?

Task 2: How Science Can Help Ageing

We want you to help us out! Could you come up with 3 ideas for how scientific discovery can help ageing? This could be in any way – from a pill that prevents our hair from turning white, to a watch that is able to predict when we are going to stop living. In order to come up with the best ideas, you need to take the following steps…

- Step 1: Do your research! You can go online (Google is always a good start!); use books or magazines; talk to people.
- Step 2: Log the sources you have used in the box below – so that you can go back to them if needed.
- Step 3: Ask yourself the following questions when going through all this information. What discoveries are already out there that can change the way I age? In an ideal world, what would these discoveries look like?
- Step 4: When logging your ideas, always make sure that you have thought of why these discoveries are relevant and interesting to you.

Please write your answers below….

Idea 1
Idea 2
Idea 3
Sources E.g. Dr K Smith (2015), An interesting scientific paper, www.science.com

Task 3: Interview a friend about their experience of ageing

- Step 1: Please pretend now that you are an Ipsos MORI researcher, and that you want to know about people experience of ageing.
- Step 2 find a friend or family member who you want to involve in this task – choose somebody you get along with, you have easy access to, and who will be open about talking about ageing.
- Step 3: ask your friend the questions below, and log their answers in this piece of paper

Please write your answers below….

How do you define ageing?

What do you like about getting older and why?

What don't you like about getting older and why?

What do you wish was different about ageing?

For more information

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About Ipsos MORI

Ipsos MORI, part of the Ipsos Group, is a leading UK research company with global reach. We specialise in researching Advertising (brand equity and communications); Loyalty (customer and employee relationship management); Marketing (consumer, retail & shopper and healthcare); MediaCT (media and technology); and Social & Political Research and Reputation Research. Over the past 60 years, the UK market research industry has grown in stature and in global influence. The companies that formed Ipsos MORI were there from the very beginning. In the Ipsos MORI story we trace the history of the firm, through its founders and luminaries, to celebrate how we have helped shape the research sector as well as the influences that have made Ipsos MORI what it is today.