



Which?

Report on the Citizens' Panel examining nanotechnologies
Prepared by Opinion Leader



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Contents

- 1. Introduction 3
- 2. Executive Summary 9
- 3. The findings in more detail 14
- 3.1 Day One: Opening the Panel and introduction to nanotechnologies 14
- 3.2 Day Two: Nanotechnologies in practice – nanotechnologies in the fields of medicine, personal healthcare, food and consumer products 29
- 3.3 Day Three: Controlling nanotechnologies and the summing up process..... 45
- 4. Summary of overall position with regard to nanotechnologies..... 53
- 5. Appendix 1: The agenda 55

1. Introduction

Opinion Leader conducted a Citizens' Panel on behalf of Which? to examine the issue of nanotechnologies and how these affect consumers. The Panel took place at Birmingham University from 29th November to 1st December 2007.

1.1 *Background and research aims*

Background

Nanotechnologies represent an enormous leap forward in our scientific knowledge and capabilities. On one hand they represent the logical 'next step' in the trend towards miniaturisation, but more than this, they offer the ability to manipulate materials at the nanoscale, meaning it is possible to alter their properties and to create new compounds. Many scientists believe that the age of nanotechnologies may represent a second Industrial Revolution, and may therefore have similarly wide-ranging impacts on many aspects of our lives.

Although nanotechnologies have been used for some time, and are the target of much investment from both governments and corporations worldwide, the numbers of finished consumer products on the market which utilise nanomaterials is currently fairly small, at around 500¹. It is very likely, however, that over the next few years many more products using nanomaterials will make their way onto the market. This is likely to happen despite the current climate of calls for prudence over the introduction of nanotechnologies from the Royal Society and Royal Academy of Engineering, amongst others. Very little is still known about the safety and longer-term effects of nanoparticles, in particular free nanoparticles. There is concern about this: nearly a hundred times as much investment has been put into, or promised for, commercialising nanotechnologies in the past five years as has been spent on researching their safety. Regulatory gaps have also been identified.

The prospect that nanotechnologies are due to become far more widespread within this climate of uncertainty is therefore a natural area of concern for Which? While the more widespread use of nanotechnologies presents impressive opportunities to consumers in widening choice and presenting new opportunities for product development, Which? is keen that consumers should be able to make educated choices about the extent to which they use nanotechnologies, and do so while being aware of the areas in which uncertainty remains. Which? is therefore planning a campaign to both educate the public about nanotechnology and push the issue up the consumer agenda. This will aim to look at the possible opportunities and benefits nanotechnologies open up, while putting pressure on the Government and others to look at the safety issues and fill gaps in regulation. As part of this process, Which? asked Opinion Leader to conduct research into consumer attitudes towards nanotechnologies.

• ¹ Woodrow Wilson International Center for Scholars, Project on Emerging Nanotechnologies (2007)

Research aims

The research was not intended to deliver a verdict, or examine whether participants were “for” or “against nanotechnologies. Rather, it aimed to address a broad spectrum of questions, with the overarching aim being to identify the key issues of importance for consumers as nanotechnologies are taken forward and come onto the market. Questions the research aimed to answer included:

- What do the public think the key benefits of nanotechnologies may be?
- What are their key concerns and the key issues they think need to be looked at?
- How do they balance the potential concerns and the potential benefits?
- What information do they need about the topic – both generally, and specifically as consumers (e.g. labelling)
- What are their “no go” areas: is there anything they fundamentally reject (and is this likely ever to change?)
- What constitutes “safety” from the public’s perspective? What reassurances do they need?
- Are there any ethical considerations they think should apply as nanotechnologies are taken forward?

1.2 *Research methodology*

A Citizens’ Panel was used for the research, as the research aims were best served by intensive discussion over multiple consecutive days in a ‘hothouse’ environment. Citizens’ Panels (also called Citizens’ Juries) are a methodology that enables this. The methodology was developed by Opinion Leader in partnership with the Institute for Public Policy Research (IPPR), and involves inviting a group of citizens (usually between 12 and 16) to meet for a period of two to four days to address a key question relating to, for example, a policy or service issue. A panel of “expert witnesses” is convened for participants to question to enable them to attain a deeper understanding of the issue(s). This methodology enables citizens to explore the issues in depth and make informed decisions for several reasons:

- **Time:** Time to understand and debate the issues arriving at informed views
- **Information:** Sufficient information is presented to the Panel as needed to brief them on the topic, the alternative viewpoints and to provide unbiased answers to questions arising
- **Scrutiny:** The Panel hears evidence from experts and individuals representing particular interests. They have the opportunity to cross examine and question those witnesses to understand their view and to explore their own thinking and ideas
- **Deliberation:** Opportunities for participants to discuss with witnesses and amongst themselves
- **Independence:** The status of the ‘group’ is independent of the project commissioners and any other interested parties

- **Authority:** The findings are expected to carry a weight of authority, derived from the independence and integrity of the process

The agenda was designed in order to allow time over the three days for the Panel to work in plenary sessions, small break out groups, pairs and individually to ensure that everyone could contribute to the process. Although the issues were complicated, and participants needed to be fully informed about these, it was also important to allow plenty of time for discussion and reflection in order to make sure the information was fully digested. A copy of the agenda can be seen in Appendix 1.

1.3 Recruitment – how the Panel and witnesses were selected

Panel recruitment

Panellists were selected broadly to reflect the general public. They were selected to represent a range of viewpoints in terms of:

- Gender
- Age
- Life stage
- Ethnicity
- Socio-economic group and/or education
- Work status (including those in full time work)

Panellists were not informed of the exact nature of the topic in advance, although they were told that it would be discussing consumer products and new developments that would be taking place in this area. This was to avoid introducing any bias in terms of attitudes to nanotechnologies (participants were told that the panel was on the subject of “the future of consumer products”). Similarly, participants were screened to make sure they were not working in the scientific field, in order to ensure that the Panel started from a similar place in terms of prior knowledge (although the fact that Panels are selected to represent the general public inevitably means that education levels and interest in current affairs will vary between panellists).

Recruitment took place using our network of independent recruiters, who followed a screening questionnaire and sample quotas in order to achieve a good mix of participants. The profile of the selected panellists can be seen in Fig. 1. Participants were paid an incentive of £255 each at the end of the Panel (£85 per day) to thank them for their time and to cover any incidental expenses.

| Demographic | Number of Panellists |
|--|---|
| Gender | |
| Men | 7 |
| Women | 7 |
| Age | |
| 18-24 | 2 |
| 25-34 | 0 |
| 35-44 | 4 |
| 45-54 | 3 |
| 55-64 | 2 |
| 65 + | 3 |
| Socio-economic group | |
| AB | 3 |
| C1 | 4 |
| C2 | 3 |
| D | 3 |
| E | 1 |
| BME (Black African or Black Caribbean and Asian – Indian, Pakistani, Bangladeshi) | 3 (1 Black African, 1 Black Caribbean, 1 Mixed White and Black Caribbean) |
| Disability | 1 |
| Working status | |
| Full time | 6 |
| Part time | 2 |
| None working | 5 |
| Full time education | 1 |

Fig. 1: Participant profile

Witness recruitment

The broad agenda (i.e. what sessions would be taking place, the topics that would be covered, and the rough amount of time to be allotted to each area) was agreed in advance with the Steering Group, who then put forward suggestions for potential witnesses in each area. The names of witnesses were put forward on the basis of not only knowledge about the area and ability to answer participants' questions on this, but also on the basis of being effective communicators who would be able to convey the complex and specific information to a lay audience.

Witnesses were secured to cover the following areas:

- Introduction to nanotechnologies
- The general potential applications and benefits of nanotechnologies
- The UK's policy, and position compared to other countries, on developing nanotechnologies
- The potential issues with regard to nanotechnologies, and concerns that have been raised

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- The applications of nanotechnologies in the medical field
- The applications of nanotechnologies in the field of food technology
- The applications of nanotechnologies in the field of consumer products
- The ways in which nanotechnologies are currently being controlled

Each witness delivered a short presentation to the whole Panel, after which the Panel discussed the presentation in small groups and developed questions. The questions were then asked during plenary question and answer sessions. It was not possible to secure a “live” witness to cover the field of personal healthcare and cosmetics. However, briefing materials to use as a stimulus for discussion were developed in collaboration with an industry spokesman, who then answered the Panel’s questions over email, and in this way the Panel was able to maintain an element of interactivity and the ability to question an expert in the field. The names of the witnesses can be seen in the Agenda at Appendix 1.

1.4 *The agenda*

The agenda was developed in six broad sessions, each corresponding roughly to a morning or an afternoon. The sessions are outlined in more detail as each section is discussed, but broadly the discussions took place as follows:

- **Introduction to nanotechnologies – 1 (Thursday morning):** Participants were given background information about nanotechnologies, such as the scale they operate on and the opportunities they represent. Participants received a presentation on the science behind nanotechnologies, followed by a short discussion and then another presentation on the possible applications of nanotechnologies. Participants were asked about their initial views of nanotechnologies: how much of an opportunity they felt they represented, how far they were concerned about nanotechnologies, their interest in the topic and the level of impact they thought nanotechnologies would have on consumers.
- **Introduction to nanotechnologies – 2 (Thursday afternoon):** Participants heard a presentation about the UK’s position with regard to the development and funding of nanotechnologies, followed by a discussion and Q&A session. They then received two presentations on the potential issues the development of nanotechnologies raise, including societal and environmental issues. A further discussion and Q&A session followed. Participants then developed a short presentation covering the main benefits, issues, areas for concern and areas for further questioning.
- **Nanotechnologies in practice – Medical and personal healthcare applications (Friday morning):** Participants delivered the presentations they had prepared the previous evening, before receiving a presentation on the medical applications of nanotechnologies – the ways in which nanotechnologies are currently being used in this area, what nanotechnologies potentially enable us to do, and possible developments for the future. A discussion and Q&A session followed, then participants were given briefing materials on the topic of using nanotechnologies in personal healthcare and cosmetics. Following further discussion, a Q&A session took place in which the medical witness answered such questions as he was able to from his field of expertise, with the

remainder being emailed through to the personal healthcare and cosmetics industry for comment and answer.

- **Nanotechnologies in practice – Food and consumer product applications (Friday afternoon):** Participants received a presentation on the food applications of nanotechnologies – the ways in which nanotechnologies are currently being used in this area, what nanotechnologies potentially enable us to do, and possible developments for the future. A discussion and Q&A session followed, then participants received a presentation on the applications of nanotechnologies in consumer products. A further discussion and Q&A session took place, following which participants added to the summaries they had prepared on the first day.
- **Controlling nanotechnologies (Saturday morning):** Participants presented their summaries from the previous evening, following which the answers received from the personal healthcare and cosmetics industry were delivered and a short discussion ensued. Following this, participants received a presentation on how nanotechnologies are currently being controlled and regulated, what regulatory gaps currently exist, and what changes to these might need to be made in the future. Discussion and a Q&A session followed this.
- **Summing up (Saturday afternoon):** During this session participants conducted an in-depth discussion on their thoughts over the course of the Panel and, looking at the presentations that each group had developed over the Panel, brought together what they considered to be their views on the main opportunities, issues and uncertainties regarding nanotechnologies, how these views might vary according to their use in different applications, the controls they thought should be in place on nanotechnologies and how to balance this with innovation. Participants concluded by establishing what they thought the main areas of importance to consumers were as nanotechnologies move forward.

1.5 The Steering Group

The project was overseen by a steering group, made up of representatives from a variety of areas who advised on the overall approach, agenda and on the selection of witnesses. The group consisted of:

- Barbara Gallani (British Retail Consortium)
- Jack Stilgoe (Demos)
- Steffi Friedrichs (Nanotechnology Industries Association)
- Nick Green (Royal Society)
- Richard Jones (Sheffield University)

In addition, the project was overseen at Which? by Sue Davies, Kate Webb and Judith Aidam.

2. Executive Summary

Background, aims and methodology

As part of Which's current campaign to inform consumers about nanotechnologies and find out what is important from the consumer point of view as nanotechnologies move forward, Opinion Leader carried out research aiming to inform members of the public about, and gauge their views on, nanotechnologies. This took the form of a Citizens' Panel with 14 members of the public, which sat for three days from 29th November – 1st December.

During the Citizens' Panel, participants were given information in the form of presentations from expert witnesses, followed by discussion in breakout groups, where they talked about their reactions to the presentation and formulated questions which they then asked the witnesses in a Q&A session in plenary. The first day concentrated on informing participants about nanotechnologies, giving them both the scientific background and some examples of the ways nanotechnologies could be used, as well as raising some of the issues and implications they might bring with them. The second day concentrated on some of the applications of nanotechnologies in more detail – discussing the medical, personal healthcare, food and consumer products applications, as well as potential issues in each area. On the final day, participants discussed the controls in place on nanotechnologies and summed up their views over the course of the Panel, and what they thought the next steps should be.

How the panel discussion progressed

Participants initially knew very little about nanotechnologies on their arrival at the Panel, with most not even having heard the term before. They found it difficult to conceptualise the scale of nanotechnologies and some found that the scientific information (e.g. about constructing nanomaterials at the molecular level) was difficult to assimilate. Participants found it much easier to understand and think about nanotechnologies when they were given concrete examples of the ways in which they might be applied.

Upon briefing and discussion, participants became very positive about the range and nature of the potential applications, particularly in the medical field. However, they found it frustrating to debate the potential issues with regard to nanotechnologies, as many of the issues raised have no easy answers and there is little in the way of concrete information about the real long term risks in particular. That said, participants recognised the value in holding the Panel at a stage before nanotechnologies take more of a hold on the market so that consumers' views would be taken into account as nanotechnologies develop further in the future. The main immediate concern that panellists had related to potential safety risks, with the initial reaction of many being that they wanted a 100% safety guarantee before they would be happy for nanotechnologies to move forward.

When the potential applications were discussed in more depth during the second day, participants found it easier to weigh up the potential advantages and disadvantages. This was because they were able to look at specific areas in depth and discuss the possible pros and cons of using nanotechnologies in each. Again, they were very positive about the potential applications. They were more accepting of the potential risks during this day, recognising that even existing technologies are not 100% safe and that there are unknowns about many of the products people currently use. However, this is not to say that safety was not still a key consideration for participants: they were still keen that consumer safety should be high on the agenda as nanotechnologies progress, and that products should not come onto the market without safety tests. The issue of informing consumers was debated: participants thought that this was difficult, as any information given to consumers about whether or not a product used nanotechnologies would have to go hand in hand with wider public education.

By the final day, participants were much more comfortable with discussing nanotechnologies, and with their possible applications and risks. On hearing about what controls are currently in place on the use of nanotechnologies in the areas discussed, they were surprised and concerned to find that there is no nano-specific legislation. They accepted the need to balance innovation with safety, but felt that if there were uncertainties about safety these ought to be addressed. At the end of the Panel, participants were very positive about the potential for nanotechnologies and the opportunities this might offer them as consumers, especially in the health field. However, they were keen that the development of nanotechnologies should take place in tandem with the development of new guidelines, standards and legislation to ensure their safety.

The specific aspects that Panellists weighed up

A feature of the Panel was that on most aspects of nanotechnologies there were seen to be both potential positives/benefits and negatives/concerns. The following points show how the implications of nanotechnologies were seen as far from clear cut and with no easy answers as to how future developments should be managed and controlled:

- The **range of applications** nanotechnologies potentially offer was seen as both a positive benefit and a serious drawback. Although participants were amazed by, and extremely positive about, the number of applications offered by nanotechnologies, they realised that this would open up possibilities in fields they were not sure about, such as military applications and surveillance, as well as in fields to which they responded more positively.
- The need to **balance caution with innovation** was identified. Participants were worried about the lack of regulation and guarantees on safety, particularly with regard to free nanoparticles, and wanted this to be addressed as a matter of urgency. However, they did not want a moratorium on the development of nanotechnologies. They accepted that other countries were forging ahead with their development and did not want the UK to lose out. They felt that to some extent the UK could not afford not to explore nanotechnologies. However, they wanted any applications used by

consumers, in particular if they were not to be told whether a product used nanotechnologies, to be safe.

- Participants were keen to ensure the **safety of nanotechnologies**, but at the same time aware that they might be asking questions of nanotechnologies that they did not currently ask of existing technologies. They sometimes expressed concern about the safety of a product produced using nanotechnologies but accepted they were happy to use its current equivalent without knowing its provenance (for example, they might dislike the idea of a nano-coating on fruit to prevent it from spoiling, but accept that fruit currently has coatings about which they knew nothing and had no safety guarantees). Although many Panellists felt that they needed to know that nanotechnologies were fully safe in whatever form they might be used, others felt they had to maintain a certain amount of faith along with scepticism.
- **Environmental issues** were of concern but some possible benefits were also seen. Participants worried about some of the things they had heard about biodegradability and the potential for long-term effects on the environment, but at the same time felt that nanotechnologies could be a positive force for environmental good (for example, by increasing access to solar power or purified water). They were further confused that no “green” groups had spoken out in either firm support or firm opposition to nanotechnologies. Participants were divided over whether it should have to be proven that nanotechnologies had no adverse effects on the environment, or whether this would be asking more of nanotechnologies than of other technologies.
- They were concerned about the **cost, power and ownership** of the products of nanotechnologies but here again some opportunities were seen. Panellists did not want the products and treatments produced to become the preserve of the rich and were very positive about the potential to democratise access to technologies such as water purification, energy storage and generic drugs, both within the UK and worldwide. On the other hand, they did not want other economies to benefit from the accessibility of nanotechnologies if this meant they would combine the knowledge with cheaper labour costs in order to secure an economic advantage.

All these issues and deliberations persisted to some extent throughout the Panel, and in particular those relating to cost, power and ownership; balancing risk and innovation; and balancing the need to maintain scepticism with a natural desire as consumers not to ask questions of every single product purchased or used.

Key findings from the Panel overall

While it was challenging to unpick the issues, ultimately Panellists were able to summarise what they saw as the key opportunities and issues, along with the controls they would like to see on nanotechnologies and what they believe should be priorities as nanotechnologies are developed further.

Main opportunities:

- The **range of applications**, which is described as “mind boggling” and potentially “a new Industrial Revolution”
- Some of the **specific applications** that were discussed, most notably in the field of medicine
- The potential to increase **consumer choice** by making products smaller, lighter and faster, and potentially reducing costs
- The opportunity to “start again” by looking at the flaws in existing materials and **designing new materials with more useful properties**
- The possibility of **helping the environment** by introducing new ways of storing energy and new biodegradable materials, or by reducing waste
- The potential opportunities for **economic development** and the jobs that this could create
- The potential to help **developing countries**, for example with food aid and cheap energy

Issues of most concern

- The potential **safety issues**, such as the toxicity of nanoparticles and bioaccumulation – participants were worried that products were currently on the market when scientists are uncertain about the safety of nanomaterials, and in particular about free nanoparticles
- The **lack of regulation** that currently exists with regard to nanomaterials, with participants being concerned that on one hand, industry is able to make positive marketing claims with regard to the new properties of nanomaterials, while denying that they may have any undesirable new properties. Participants were therefore concerned that industry should not be allowed to regulate itself. Also, there was concern that there was no nano-specific regulation currently in place, and that any regulation had to be applied internationally or it would not protect consumers in a globalised market
- The fact that there is no **requirement to inform** consumers about the extent to which nanotechnologies have been used in products (although it was acknowledged that informing them might not be useful without an accompanying programme of public education). Participants were also more concerned about free nanoparticles than fixed (although they expressed this in terms of greater concern about substances that were taken into or applied to the body or could leach out into the environment, rather than be contained in a device)
- Some of the potential **applications** to which nanotechnologies can be put, which included some that participants were less comfortable with, such as military and surveillance applications

- Questions over whether nanotechnologies would be **accessible to everyone**, or whether they would be only for a few rich people or richer countries
- The possible **environmental** impacts – whether nanoparticles may enter the environment or persist there longer than current particles

Controls they would like to see

- Participants wanted to see the issue of making current **safety standards and regulation applicable** to nanotechnologies addressed as quickly as possible. They were keen that regulators should take and follow advice from scientists currently assessing the risks involved in nanotechnologies, rather than bowing to pressure from industry
- Suggestions for who should regulate nanotechnologies included **greater Government involvement**, and the setting up of an **independent body or bodies** to regulate nanotechnologies either in general or in specific areas
- Panellists stressed that regulation should be applied **internationally**, or it may not protect consumers in a globalised market

What the Panel believes should happen as nanotechnologies move forward

- The Panel wanted the issue of **regulation** to be looked at urgently
- Panellists believed that **consumers should be informed** about nanotechnologies – both whether they have been used in developing products, and more widely about what the issues are concerning nanotechnologies, in order to help them decode any information they are given on labels. They were particularly vocal about the need to inform consumers about products containing free nanoparticles (although this was expressed in terms of products/substances containing particles that could get into the body or environment rather than using this term)
- Although the Panel did not call for a halt to the development of nanotechnologies, they were keen that they be developed with the highest regard for **public safety**

3. The findings in more detail

3.1 Day One: Opening the Panel and introduction to nanotechnologies

Key insights:

- There were a number of wider societal issues raised with regard to any new technology
- Initially people found the concept of nanotechnologies difficult to understand: it takes some time for them to get to grips with the scientific understanding required; nanotechnologies are also conceptually very difficult to visualise
- Participants found it easier to understand nanotechnologies when they were given specific examples of their applications
- Initially participants saw endless opportunity in nanotechnologies, although there was also some realisation that possibilities would exist to do harm as well as good
- The potential applications of nanotechnologies were received very positively, particularly with regard to health and medicine
- There was some concern when the potential issues with regard to nanotechnologies were raised, with participants wondering whether the information was being kept from them
- Participants found the task of trying to discuss nanotechnologies in the absence of concrete answers frustrating: for example, they were willing to weigh the issues against the benefits, but found it difficult that they could not have definite information about the exact risks and exact benefits
- Safety was the key concern, followed by the possible environmental and societal impacts of nanotechnologies

3.1.1 What the day involved

The aim of the day was to get participants “up to speed” on the scientific background to nanotechnologies, and to introduce some of the theoretical context to provide a backdrop against which participants would later consider the applications of nanotechnologies. The day aimed to inform participants about, and gauge their initial reactions to:

- The scientific background to nanotechnologies
- The potential ways in which nanotechnologies may be used and the opportunities they open up
- How far the UK is investing in nanotechnologies and how this compares to other countries
- Some of the wider issues that have been raised about nanotechnologies and how they impact on society

The Panel was opened on the morning of 29th November 2007 by Opinion Leader and participants were thanked for coming to participate in a discussion on the future of consumer products. Initial introductory sessions followed, where the issue of technology was explored and the definition to be used in the Panel given. The groups came back together into a plenary session where the scope of the Panel was further outlined by Opinion Leader and Which? gave a short presentation on why they had decided to

convene the Panel. Background materials such as a handout explaining the scale on which nanotechnologies operate and a glossary were distributed.

The remainder of the day was devoted to presentations and deliberation, following the formula of delivering the presentation first, then discussing it in two smaller breakout groups, establishing respondents' positive and negative reactions and asking them what further information they felt they needed. Presentations were given on:

- **The science behind nanotechnologies** – an introduction including the scale, what the ability to manipulate materials at the nanoscale means, the new opportunities that are opened up and what is made possible that was not before. Examples of some of the current research that is currently going on, and its implications
- **The Government's policy in regard to nanotechnologies** – a general overview of UK policy and how this compares to other countries. The implications of this, for example calling for tighter or looser controls
- **The applications of nanotechnologies** – an overview of the applications that currently use nanotechnologies and the potential uses of nanotechnologies in the future/where the application of nanotechnologies might lead us
- **The issues and implications of nanotechnologies** – why some people are worried about some aspects of nanotechnologies, who is concerned and what are they saying. Overview of the potential positive and negative issues and implications.
- **The issues and implications of nanotechnologies from an ethical point of view** – the social and ethical issues nanotechnologies raise and why people are concerned about these. The possible environmental issues and how far these have been established.

During the day, participants were also asked to complete an individual exercise about how much opportunity and need for caution they personally saw in nanotechnologies. The day closed with participants preparing a summary, in two breakout groups, of the key opportunities and issues they felt to be of importance, and the further information they felt they most needed.

3.1.2 Presentations and deliberations

Session 1: Initial associations with “technology”

Following the welcome to the Panel, participants were split into two smaller groups and asked:

- What they tended to associate with the word “technology”
- How much they feel they generally know about technology and how confident they feel with it
- The new opportunities and issues raised as new technologies develop

A wider definition of technologies, encompassing medical technology, personal care, food and consumer products was given, and participants received a handout showing technological

developments that had taken place over the past few thousand years in order to get them to think about technology in its widest possible sense. The concept of nanotechnologies was explained using the Royal Society's definition, and participants were given a chance to discuss their initial reactions and formulate initial questions.

Although these initial discussions were about technology in general, and took place before the concept of nanotechnologies had even been introduced, they are worth bearing in mind when considering the findings of the rest of the Panel. Many issues were raised at this stage that were later raised with regard to nanotechnologies – therefore they are wider considerations that participants apply to new and even current technologies, and are not necessarily specific to nanotechnologies (although some of the issues may apply to a greater or lesser extent with nanotechnologies than with other technologies).

- Initial, spontaneous **definitions of technology** centred at first on electronic and even futuristic applications, with associations such as “computers”, “tomorrow’s world” and “robots”. It is perhaps worth bearing these initial associations with the word “technology” in mind given participants’ later warnings about the word “nanotechnology”. On further discussion, however, participants settled on a wider definition encompassing any interface between humans and tasks.
- There was wide agreement that people were **confused about technology** and the pace at which it is developing. Participants often said they felt that the pace of development was too difficult for them to keep up with, either mentally (in terms of getting to grips with and learning how to interact with new technologies) or financially (as soon as one device becomes accessible financially it is often approaching obsolescence).

“Especially on mobile phones. By the time you want to buy the latest one there’s another one.”

“Products are developing so quickly that I think I’ll just wait a couple of generations before I buy something because it’s so expensive”

- Some (although by no means all) of the men had an interest in keeping up with new consumer electronics technology from a **“gadgets” or “boys’ toys”** perspective, viewing it almost as a hobby.

“I love electronic technology – I could spend hours in computer places and phone places – I think it’s a bit of a blokey thing – I’ll work out how to use it and just play with it.”

- Participants identified several new **opportunities** new technologies brought with them, such as:

- Increasing human capacity and efficiency in the tasks that can be carried out, for example reducing human error and enabling more to be achieved in a similar timeframe and multitasking
- Making communication easier
- Potentially freeing up leisure time
- Enabling completely new tasks to be carried out, for example seeing inside the human body without exploratory surgery

“With medical breakthroughs I would have more faith in a computer than a human – cause doctors are fallible, but with a computer it’s either one or the other – you can kind of trust the computer eye more than the human eye – they don’t miss things but humans can.”

- However, participants also identified some **wider issues** they felt new technologies raised, for example:
 - Over-reliance on and “blind faith” in technology, which may be fallible (e.g. sat navs and computers which may crash)
 - Lack of privacy in a surveillance society, and one where personal details are stored electronically, making them easy for people to access and use fraudulently
 - Dangers new technologies can pose if they are brought to the market without being properly tested: for example Thalidomide, and the uncertainty that until recently existed over mobile phones
 - The stresses new technologies can cause in the initial stages, when people are trying to work out how to use them
 - The diversity of experience technology enables – although this is positive from a leisure point of view, it may corrode the “shared experiences” that participants feel used to bind society together

“Big Brother... With CCTV people are always watching you, and I don’t think that’s a good idea.”

“Anyone can go on a computer and get all your details – it’s scary.”

The concept of nanotechnologies was then introduced. Although few participants had heard of nanotechnologies, some had, although not to the extent that they were able to give a detailed explanation or definition.

Session 1: Initial reactions to the concept of nanotechnology

Following the preliminary introduction to the concept of nanotechnology, participants had some very general initial reactions to the concept. Although these were very topline at this stage, it is worth considering them and pulling them out, as they may provide a clue to the state of mind of a layperson after hearing or reading a little information about nanotechnologies.

Initial reactions fell into the following categories:

- Confusion: either inability to understand the concept on the strength of the initial information given, or a difficulty in comprehending and processing the concept of working with technologies at such a tiny scale

“You might as well be speaking French to me – it’s a lot to take on board.”

“I’m feeling a bit ‘hoo’ – it’s mind-boggling when you look at it”

“It’s hard to understand the size of it.”

- Thinking about how nanotechnologies might benefit or influence the development of existing products or technologies, improving portability, speed and accuracy

“It’ll make things smaller and lighter.”

“We used to work to a millimetre in engineering and that was accurate – but now this is obviously state of the art.”

- Perceptions that nanotechnologies may not offer a revolution, but instead represent an evolution in terms of the increasing trends towards miniaturisation, and an assumption that this is something that other countries may have been doing for years (and therefore that the issue of nanotechnologies is not something new on the consumer agenda)

“As the years go on things get smaller... the first mobile phones were bricks.”

“If you think of our technology compared to the Japanese – we’re like, ten years behind.”

- A generalised view that nanotechnologies were going to be useful, without necessarily being able to be specific about how this would be the case

“I think the changes are for the best.”

Participants were strongly interested in the potential applications of nanotechnologies, with the potential applications in medicine and in consumer electronics arousing particular curiosity.

Participants then moved back into plenary to hear the first expert witness.

Session 2: An overview of the scientific background to nanotechnologies

The first expert witness was Dr. Nicole Grobert from Oxford University, who delivered a presentation about the scientific background to nanotechnologies.

Witness: Dr. Nicole Grobert, Oxford University – Scientific Overview

Nicole Grobert delivered a scientific overview of nanotechnologies. She started off by showing how widespread the use of the word 'nanotechnology' is in the news, on the Internet and as a marketing ploy, which can cause confusion over what it really means. She went on to give a definition of nanotechnologies as anything working at the nanoscale and explained how small this really is. Nicole also explained about how atoms and molecules work together and used plastic models to demonstrate how nanotechnologies can be used to create different forms of carbon. She explained how nanotechnologies can change the way substances are made up, which can give a substance useful new properties. She also gave examples of some current applications of the technology and potential future developments, such as lighter and stronger materials and water purification.

Following the presentation, participants split back into their discussion groups to discuss their reactions to the presentation, formulate questions and establish the further information they felt they needed. After this, the group moved back into plenary and spokespeople asked the questions.

- Key positive reactions to the scientific presentation:
 - Participants were struck by the thought that it would be possible to change some of the properties of materials without changing all of them: for example, a cup or plate that looks exactly the same but will not break, or is magnetic. Although participants could not see a use for this particular example, some were readily able to imagine that useful combinations of properties might exist.

“The magnetic cup might be a frivolous example, but there might be a time in the future when we might need a material that does this.”

- Nanotechnology seemed to have potentially infinite possibilities to participants at this stage. They found it difficult to grasp the enormity of the range of the things nanotechnologies would enable, but were very positive about this.

“It gives a wider range of what we can put together – like in cooking.”

“We are only limited by the imagination.”

“Opportunities – I think the sky’s the limit really.”

- Key negative reactions to and issues raised about the scientific issues presentation

- Negative reactions to some extent overlap with issues raised. Participants identified issues of concern, and felt that if these were not adequately addressed it would move their views on nanotechnologies towards the negative. Some of these are not specific to nanotechnologies but apply more generally to new technologies.
- The issue of not being able to “see” nanotechnologies (i.e. that something has happened the results of which are visible, but the mechanics of which are invisible) created some discomfort with the concept. Participants worried that if things went wrong on a small scale, they might be difficult to fix or have irreversible effects.
- Participants were concerned that new materials might come onto the market without being thoroughly tested. This was a spontaneous raising of the concept of the adequacy of existing safety tests: participants felt that if new materials were only subject to the same safety tests as existing materials, they might later prove to have unsuspected and undesirable properties.

“What if they produce a new rubber but they’ve missed something and when you’re going down the motorway the tyres suddenly go? That’s worrying.”

- Although some participants were able to make the link between the examples given in the presentation and the possible creation of new materials other than those described, others were fixated to some extent on some of the casual examples given and their possible usefulness. This is worth bearing in mind during any future information delivery to lay people.

“Will we need a material that sticks to metal?”

- Some participants instinctively drew an analogy with genetic modification, feeling that the manipulation of atoms was “unnatural” in the same way as the manipulation of DNA. This is also something that is worth considering when informing lay people in future: although the analogy may be a natural one to draw, the risk is that views on nanotechnologies may be influenced and contaminated by existing entrenched views for or against GM.

“Maybe the manipulation of atoms to create something is unnatural – the Frankenstein example.”

- Participants were keen that nanotechnologies should be used to make everyone's lives better, and would not just benefit those who could afford them. This theme was raised repeatedly throughout the Panel, and particularly with regard to the medical applications of nanotechnologies, but first surfaced here.

"Inclusiveness is important – that these changes and applications make everybody's lives better, not just a select group."

- Participants were also keen that any changes made should be reversible – that a change should not be made if it was not going to be possible to stop using the technology. They also wanted the adoption and uptake of nanotechnologies to be voluntary and not imposed on the public. Again, an analogy with GM was made – this time with crop trials – to illustrate both of these points.

"You might take a step and not be able to go back"

- Finally, many participants still found the entire concept difficult to get to grips with at this stage, and therefore found it difficult to formulate any sort of an opinion or reaction.

"It's quite hard to take it all in – I'm quite confused to be honest."

- Further information needed

Participants wanted further information on the following:

- More information about the applications and uses of nanotechnologies (particularly in medicine, which was a key area of interest to participants) to make it easier to imagine the ways in which they could be used, and assist in evaluating their benefits and drawbacks
- How expensive nanotechnologies will be, especially in the early stages (and therefore how likely it is that any benefits will be unevenly distributed)
- Whether there were any potential environmental implications
- Whether nanotechnologies will automatically require specialists to deal with, and therefore be impossible for the ordinary consumer to understand
- What the potential for misuse is, and whether enough thought has been given to this

Session 3: An overview of the applications of nanotechnologies

In a slight change to the agenda as initially developed, Professor Richard Jones of Sheffield University then delivered a presentation on the potential applications of nanotechnologies before the Panel broke for lunch. The decision to change the agenda in this way was taken because Panellists were keen to

know about the potential applications of nanotechnologies, and to some extent this was impeding discussions.

Witness: Professor Richard Jones, Sheffield University – Applications and Benefits

Richard gave an overview with some examples of how nanotechnologies are being used now and possible uses in the future. Currently nanotechnologies are used in cosmetics, materials for cars, paints, anti-bacterial coatings and in medicine. He explained how nanotechnologies are used in sunscreen, carbon nanotubes and anti-cancer drugs. Richard also explained the difference between self-assembled nanoparticles and engineered nanoparticles, and how nanoparticles occur naturally. Looking to the future, he highlighted that nanotechnologies could enable computers to store more information to make them faster. Richard also outlined how nanotechnologies might be used to provide sustainable energy in the future as nanoparticles can be used to make solar power panels out of plastic.

Following this, participants went back into their breakout groups in order to discuss their reactions to Richard's presentation. They discussed their positive and negative reactions, formulated questions and established what further information they felt they needed. They also completed an individual exercise where they were asked to rate how they personally felt initially about the opportunities presented by nanotechnologies, how cautious they felt about nanotechnologies, how much impact they saw them as having on consumers in general, and their personal level of interest in the subject.

- Key positive reactions to the applications presentation
 - Again, respondents were struck by the sheer scope of the opportunities presented by nanotechnologies. One participant spontaneously compared the advent of nanotechnologies to a “new industrial revolution”.

“I can't see anything that can't be changed. It's an opportunity to start again at the beginning, picking the faults out of the materials we have and modifying them.”

- Discussions inevitably centred on the examples given in the presentation, but participants were most struck by the potential health and medical applications, by the potential to apply nanotechnologies to make solar power more accessible and reduce dependency on power stations, and by the potential improvements to the speed and power of consumer products. They also thought that it would be possible to use nanotechnologies in other ways to overcome the limitations of existing materials and reduce their harmful effects – for example, changing the plastic used in carrier bags to make it biodegradable and counteract their effect on the environment.
- Participants thought that there was the potential to make certain technologies cheaper, potentially democratising access.

- Key negative reactions to and issues raised about the applications presentation
 - Negative reactions to, and issues raised, again overlapped to some extent and are therefore presented together.
 - The level of uncertainty about nanotechnologies and their potential long-term effects was something that concerned Panellists. This was raised repeatedly over the course of the Panel and was discussed in some depth, particularly on the last day. Although participants accepted that to some extent the long-term effects of new technologies are always unknown, they felt concerned about nanotechnologies for two specific reasons:
 - The wide-ranging applications of nanotechnologies, meaning that any potential drawbacks would also be widely felt
 - The fact that products containing nanomaterials or utilising nanotechnologies are already on the market, without participants knowing about this. Concern was heightened when the potential drawbacks were discussed in the presentation, as some participants worried that they might have been using nanotechnologies unknowingly. (In further discussions, many people felt they would still use products containing nanoparticles or using nanotechnologies, however. It was the idea that they might have done so unknowingly and – to an extent – without their consent, that aroused concern.)
 - However, some participants were fairly sanguine about the prospect that they might have used nanotechnologies unknowingly, believing that they were only concerned at all because of the information they had received from participating in the Panel.
 - Allied to this, Panellists were concerned that a “gung ho” attitude might be being taken towards the development of nanotechnologies. They suspected strongly that both Government and corporations might be more inclined to carry out research and deal with any potential problems later.
 - There was concern about some of the specific properties that nanomaterials and nanoparticles may or may not have. For example, the issue of the potential toxicity of reduced-size molecules was spontaneously raised. Participants worried about whether breaking materials down and rebuilding them was necessarily safe. Equally, they were concerned about the durability of nanomaterials and whether they would persist in the environment when they were no longer being used by consumers.

“If we can’t break things down, like an indestructible plate, how will that affect our environment?”

“Recycling is important – if we can’t get rid of it we don’t need it.”

“There’s a big push for recycling now, so if we have this new technology that you can’t recycle at all then that’s a big problem.”

- Again, there was concern about equality of access to nanotechnologies. In particular, the fact that the presentation had referred to some of the potential medical applications meant that participants worried that a “postcode lottery” might limit access to treatments.

“Will I benefit from it? Or is it just a money-spinner to benefit rich people with cancer?”

- Panellists were suspicious that nanotechnologies might present corporations with an opportunity to charge more money for their products by blinding consumers with science. They also thought that Government might use any involvement it has to raise taxes.

“Now they can take advantage of people and charge the earth for something – all this nanotechnology can be a big con and an excuse for charging a lot more.”

“I’m always really concerned about anything the government can stick their noses in and put up taxes.”

- Participants were also concerned that nanotechnologies might also present those who wished harm on others with new opportunities. Although they accepted that with all new technologies there was the potential to use them for harm as well as good, the unique opportunities presented by nanotechnologies were thought to create a strong potential for new risks (for example, terrorists swallowing “nano-bombs” that would be undetectable).
- The issue of whether nanotechnologies might be being seen as a “catch-all” solution also exercised some, who pointed out that sometimes a low-tech solution might be as or more effective, and that nanotechnologies might not therefore always be needed or desirable. Some people said, for example, that they did not want the shelf life of food to increase, or that they would prefer a “natural” solution to a problem such as agricultural pest control.

“Do we really need a nano coated plastic bottle for beer? It won’t really benefit the public, it’s not helping the environment.”

- Further information needed

At this stage, Panellists wanted further information on:

- The likely timescales involved in the introduction of nanotechnologies – or were they being introduced onto the market already?
- Specific timescales for the introduction and widespread availability of specific products and treatments they were interested in (e.g. solar panels)
- What research was currently being carried out and the safety guarantees that were possible
- Whether the biodegradability of nanomaterials will be slowed or prevented in comparison to their larger-scale counterparts
- How can the general public be informed about nanotechnologies? Panellists felt it was very important for consumers to be given an informed choice about whether to use products using nanotechnologies, but did not see how an informed choice was going to be possible for the general public to make without substantial education on the topic.

- Individual exercise

Participants were asked to fill in a short individual exercise sheet at this stage, which aimed to assess individual levels of interest, concern and opportunities seen in nanotechnologies, and the impact participants thought they would have on consumers. For each question, participants rated themselves on a scale of 1-10 based on the initial information they had at that stage, with 1 being the least and 10 the most.

- Interest in nanotechnologies: In response to the question “How interested are you in the idea of nanotechnologies?” answers ranged from 4 to 10 (average 7)
- Opportunities seen in nanotechnologies: When asked “How much opportunity do you see in nanotechnologies?” answers ranged from 6 to 10 (average 8)
- Concern about nanotechnologies: The question “How cautious do you feel about nanotechnologies?” drew answers ranging from 4 to 9 (average 6.5)
- Impact nanotechnologies will have on consumers: When asked “How much impact do you think nanotechnologies will have on consumers?” answers received ranged from 7 to 10 (average 9)

Participants then moved back into plenary for a further presentation.

Session 4: An overview of the potential issues and implications of nanotechnologies

Richard Jones then gave a presentation on the UK’s policy with regard to nanotechnologies, following which participants heard two presentations on the potential issues and implications of nanotechnologies: Richard Jones presented an overview and Dr. Robert Doubleday from the Cambridge Nanoscience Centre focused on the ethical and environmental implications of nanotechnologies.

Policy Overview

Richard Jones explained that governments around the world are in a race to promote nanotechnologies to boost economic growth, with some predicting nanotechnologies will be a '\$1 trillion industry by 2015.' The UK government is fairly conservative in the amount it spends on nanotechnologies research compared to other countries. Countries such as China and South Korea are emerging as big investors. But governments are also under pressure to ensure that proper safeguards are developed, particularly in response to some lobbying organisations who are raising concerns about possible risks. To date, the government has made some progress towards encouraging more research in nanotechnologies including commissioning a Royal Society working group in 2004. But the Council for Science and Technology concluded in March this year that much more research needs to be done to assess possible risks, which may be helped by international coordination with the EU and OECD.

Issues and Implications

These presentations addressed some of the concerns that have been raised over the safety of nanotechnologies and their possible wider impacts. The main area being investigated at the moment is that of toxicology, in response to concerns that substances reduced to a nanoscale may be more toxic than in their usual state. The worries that some people have about nanotechnologies leading to a loss of privacy, 'human enhancement' and "nanobots" taking over the world (which was pointed out was impossible) were mentioned. There are also issues of social justice to address: whether the development of nanotechnologies will increase or decrease the gap between rich and poor countries; whether it will take away jobs or create new ones and whether they will lead to environmental problems or enable us to generate power more cleanly.

Participants then moved back into their breakout groups and discussed their reactions to the presentations, following which they identified questions for the Q&A session.

This was the stage at which the Panel became most concerned about nanotechnologies. Having spontaneously identified many of the potential issues themselves, they became concerned when they then received a formal presentation on these, as it both reinforced some of their fears and made them think that perhaps there were further things they should worry about, and which they were not being told. These concerns were given full rein as Panellists did not yet feel they knew enough about the applications of nanotechnologies to give them sufficient benefits to weigh against the potential issues. Panel opinion was later to swing back to some extent, during the subsequent days.

Particular concerns included:

- How far is it possible to guarantee the safety of nanotechnologies? Participants varied in their views on the level of safety they wanted. Several said that they wanted a 100% guarantee of safety; others felt that this is never possible and that all technologies come with some degree of risk. Participants did, however, find it difficult that they were not able to access information on the precise extent of this risk, in order to weigh it up against the benefits

"I need to know that it's 100% safe in whatever situation."

- The potential military applications of nanotechnologies – whether they will be used as a way of killing people or asserting the rights of countries with access to these new military technologies over the rights of countries without these.

- Reaction to military applications was not universally negative, however, with some Panellists pointing out that military applications do not have to be directly concerned with “killing people” and may have civilian.

“If it’s just used to develop ballistic missiles, it doesn’t enthuse you to support it.”

“Military applications doesn’t just mean killing people – there are military applications that can be used in the wider world, like those Kevlar stab vests for police.”

- The surveillance applications of nanotechnologies – will they be used to keep a closer eye on the population; do they enable any forms of surveillance that do not currently exist?

“The idea of greater surveillance worried me – the UK is one of the most surveyed country anyway – and its ok with a benign govt. but what if you didn’t have a democratic government, what could they do with it?”

- If nanotechnologies have the potential to help the developing world, what is the likelihood that they will actually be used to do so? Or will they be another means by which the developed world makes money out of other countries?
- Who owns scientific discoveries? Is there any way of maintaining the research capabilities of large corporations, while making sure they are not able to keep new discoveries that could potentially benefit humankind as a whole, to themselves?

This was also the stage at which participants felt that they had very few answers, which they found quite difficult. They wanted to weigh up concrete information about risks and benefits, rather than being expected to grapple with the unknowns that currently exist regarding nanotechnologies.

“It seems the further we go along, the less answers there are. I’m OK with the technology, but if you ask what applications, they don’t seem to know, or where the funding is, or what the downsides are.”

Many very contradictory feelings and opinions were expressed as the Panel became more involved in the issues. Participants were fully aware of the contradictions inherent in many of their discussions, and often found it frustrating that they were not able to come up with a firm answer.

Questions raised during the final Q&A session of the day were:

- How likely is it that Government would cover up potential risks in order to benefit from any money nanotechnologies bring into the country?
- What is the likelihood that nanotechnologies might help to address worldwide economic issues, for example in Africa?

- What limits exist on patents? (How likely is it that people will make a discovery that could benefit humankind as a whole and then keep it to profit from it themselves?)

The final activity was for participants to prepare a short presentation on what they felt the key opportunities, uncertainties and issues posed by nanotechnologies were, and the key further information they felt they needed. Across the two groups these presentations covered the following:

- Key opportunities:
 - Health (both diagnostics and treatments)
 - Miniaturisation/portability in consumer products
 - Possibility of creating jobs and stimulating economic development
 - Lower unit costs
 - Opportunities to develop new materials
- Key uncertainties and issues:
 - Risk, regulations and ensuring safety
 - Need for more and earlier assessment and regulation
 - Educate companies about what they need to be doing to ensure consumer safety
 - Whether there will be any problems in the future
 - Need to inform consumers about whether products utilise nanotechnologies
- Key further information needed:
 - Safety guarantees
 - Reliability
 - How it is likely to affect product costs (and whether everyone will be able to afford it)
 - Impact (whether positive or negative) on future generations

3.2 Day Two: Nanotechnologies in practice – nanotechnologies in the fields of medicine, personal healthcare, food and consumer products

Key insights:

- Participants found it much easier to discuss both the potential benefits and the potential issues and implications of nanotechnologies when the detailed presentations were given, which gave further information about the potential applications and enabled Panellists to “ground” both the potential applications and risks in actual examples
- Participants were very positive about most of the areas in which nanotechnologies could be applied; however, they were keen that this should be with the proviso that safety should be assured
- The applications that elicited the most positive response were in the field of medicine and consumer products. There were more mixed reactions to using nanotechnologies in the areas of food and personal healthcare/cosmetics, based around perceived need and perceived risks
- Participants were willing to accept looser guarantees on safety during this day, realising that no technology can ever be considered 100% safe, and that to this extent nanotechnologies are no exception. However, they were keen that the issues of safety, environmental effects and wider societal impacts be considered

3.2.1. *What the day involved*

The aim of the second day of the Panel was to give participants a better idea about both the potential applications of nanotechnologies and the potential issues for consumers that might be raised, with the focus again being on informing participants in detail about specific areas through expert witness presentations, before testing their responses during discussion and Q&A sessions. In order to give Panellists a better idea about the applications and issues for nanotechnologies, the presentations and discussions were grounded in four specific areas. These were:

- Nanotechnologies and medicine
- Nanotechnologies and personal healthcare (including cosmetics)
- Nanotechnologies and food/food technology
- Nanotechnologies and consumer products (including any products consumers might buy or use that were not covered in the other three categories)

The day opened with a welcome back from Opinion Leader and from Which?, along with a reminder of why the Panel had been convened. Both Opinion Leader and Which? stressed that a number of the questions participants would be considering did not have any easy answers, but that their discussions and any questions arising would still be vitally important in establishing the issues of most importance to consumers.

During the day that followed, participants were asked before each topic to think of the possible uses or applications of nanotechnologies in that area, and any possible issues or problems they could identify with using nanotechnologies in the area. Following this, a presentation was given from an expert working in that field (for all but the personal healthcare session, where briefing materials prepared in collaboration with an industry representative were used instead), and participants then had time to discuss the issues raised and their reactions to the presentation, and to formulate questions before a plenary Q&A session. They split into two breakout groups (different from the previous day) in order to do this. The presentations were as follows:

- **Nanotechnologies and medicine** – an overview of the current and potential applications of nanotechnologies in the field of medicine. What nanotechnologies make possible that was not possible before, and any positive or negative issues or implications of this.
- **Nanotechnologies and personal healthcare (including cosmetics)** – briefing materials presenting an overview of the current and potential applications of nanotechnologies in the field of personal healthcare and cosmetics. What nanotechnologies make possible that was not possible before, and any positive or negative issues or implications of this.
- **Nanotechnologies and food** – an overview of the current and potential applications of nanotechnologies in the field of food. What nanotechnologies make possible that was not possible before, and any positive or negative issues or implications of this.
- **Nanotechnologies and consumer products** – an overview of the current and potential applications of nanotechnologies in the field of consumer products, meaning any products that might be bought or used by consumers, and not covered by the other presentations. What nanotechnologies make possible that was not possible before, and any positive or negative issues or implications of this.

At the end of the day, participants were again asked to complete the individual exercise about how much opportunity and need for caution they personally saw in nanotechnologies. As with the first day, the final activity was for participants to prepare a summary, in two breakout groups, of the key opportunities and issues they felt to be of importance, and the further information they felt they most needed.

3.2.2 *Presentations and deliberations*

Session 1: Nanotechnologies in medicine

After the welcome back to the Panel and delivery of the participant presentations from the previous evening, participants were asked to move into three small, self-moderated groups and spend time discussing the potential applications and benefits of using nanotechnologies in medicine, and any possible issues and implications.

Benefits initially identified by participants were:

Opinion Leader

30

- Targeted delivery, especially of cancer drugs, to reduce side effects
- The potential to deliver drugs in new ways (for example through creams rather than injections)

Possible issues were:

- The cost of research: participants were keen that all should benefit, should taxpayers' money be used to fund research
- Who would benefit from the new treatments developed – would it be for everyone?
- Whether nanotechnologies would prove to be falsely promising and a waste of money “*another Millennium Dome*”
- More information needed: some participants were keen for a 100% safety guarantee, but others accepted that this would probably never be possible. However, they were keen to get more information about the risks, as it was felt that a known risk is less worrying than doubt.

Professor Clive Roberts from the University of Nottingham then delivered a presentation about the use of nanotechnologies in medicine.

Witness: Professor Clive Roberts, Nottingham University – Nanomedicine

Clive Roberts gave an overview of how nanotechnologies are currently used in medicine, how they could be in the future and how to address potential risks to humans. He explained that nanotechnologies are inspired by what we find in nature, such as viruses which operate at the nanoscale. Nanotechnologies can be used to create ‘smart’ medicines by using nanoparticles to contain a drug, or to make drugs that recognise diseased cells and release the medicine only when they come into contact with these, reducing side effects. In the future, we may be able to use nanotechnologies to help recognise the first signs of disease and deliver treatment before it takes hold.

Assessing potential risks to humans from nanomedicines is very important, as certain substances have different properties at the nanoscale and therefore may be more toxic to us. Clive is confident that more understanding of the impact of nanoscale particles will develop quickly in the field of nanomedicine as new products are developed in this highly regulated industry.

Following this, participants moved into two breakout groups (selected to be a different mixture of people from the day before) to discuss in further detail their reactions to the presentation – their positive and negative reactions, and any areas where they wanted to ask a question or get further information.

- Key positive reactions to the nanotechnologies in medicine presentation
 - Participants were very positive about all of the treatments and procedures talked about in the presentation. They found it difficult to identify any areas about which they were negative.

“It’s all positive.”

- People expressed a willingness to take more risks and deal with a certain level of uncertainty with regard to nanotechnologies and medicine.

- They were, on the whole, much more tolerant of uncertainty in this area than in many of the other areas examined, and much more willing to accept a certain level of doubt than they had been the previous day.
- In part, this was because of the potentially life-saving nature of medical treatments

“I think people who have cancer won’t care about the effects, they just want to survive.”

“I would imagine we’d be prepared to take much more risk if you are likely to lose the thing that is most precious to you.”

- However, it was also because participants realised that they were willing to accept doubt and potential side-effects with current treatments. They were therefore prepared to accept these on “quality of life” as well as “life-saving” treatments, and on diagnostics.

“You open any packet of paracetamol and the first thing you see is the little leaflet warning you about the side effects.”

“Too much knowledge isn’t helpful.”

- Participants also felt more comfortable with the idea of using nanotechnologies in medicine than they did in many other areas, as they had confidence in the rigour of the existing trialling and testing regime that treatments go through before coming onto the market.
- Finally, many (although not all) participants automatically trusted any treatment prescribed by a GP or specialist, and assumed that this would mean it was certain to be safe. Others thought they would be wary of any new medicine.

“As long as the doctor says it’s OK to use it, I would like it.”

“I think it’s like with anything new that comes on the market, you’re always a bit wary before it’s been tried and tested.”

- Key negative reactions to the nanotechnologies in medicine presentation
 - There were very few negative reactions to anything directly raised in the presentation. However, there were a few areas of concern about some of the possible implications.

- Some felt that they would be wary of any unknown treatment, including nanotechnologies. They acknowledged that this was not necessarily a “rational” fear. However, because nanotechnologies are in themselves new and unknown, they felt that education was very important in order to take public opinion along with researchers and medics.

“I think it’s a primeval thing – everyone’s naturally wary of the unknown.”

“Don’t trammel over public opinion – it might be that a drug has great benefits for a community but you need to take the community with you, otherwise a community might reject something that is good for them.”

- The potential for misuse worried some, whether for bio-terrorism or using nano-enabled medicines illegally (however, others felt that this was not an issue specific to nanotechnologies and is already the case with existing medicines)

“If they get AIDS as a nano, what’s stopping people going on a train and giving it to everybody?”

- As with some of the other presentations, there was a slight tendency among some to focus on the examples presented. There was therefore some criticism of scientists and researchers because they were not perceived to be focusing their efforts in other areas.

“They’re only concentrating on cancer, not AIDS.”

- Key questions and areas for further information about nanotechnologies and medicine

- There were some questions about the **potential for misuse** – for example, whether nano-drugs will get onto the streets and be used illegally, or the likelihood of their being used by terrorists. However, it was largely accepted that this is no different to existing misuse of medical drugs and bio-terrorism issues, and that these threats are already in place with conventional medicine.
- Although many of the issues raised in response to the presentation were not specific to nanotechnologies, the **size of nanoparticles** again raised some concerns. Some felt automatically wary because they could not “see” nanoparticles; others were concerned that the size of nanoparticles might make them work in a different way to conventional drugs. They were, for example, worried that nanoparticles might compromise the immune system (the issue of existing drug delivery systems having to be designed specifically to bypass the body’s immune responses was then raised by Clive Roberts in response to this).

- Participants wanted to know more about the **range of conditions** that could be addressed with nanotechnologies. They were also interested in the potential of gene therapy.

Session 2: Nanotechnologies and personal healthcare/cosmetics

Pre-prepared materials were handed out and then read out by the moderator, after which Panellists moved back into their breakout groups to discuss the potential benefits and issues. As with the other presentations, they were then able to identify questions to be asked – to Clive Roberts in the first instance, who fielded any general questions; and then to an industry spokesman, who fielded specific questions over email.

Personal healthcare and cosmetics handout

The handout gave an overview of how nanotechnologies are currently being used in the cosmetics industry, possible new developments and potential issues and implications resulting from these. Currently, nanotechnologies are used in anti-wrinkle cream, other moisturising products and sunscreen. In these products nanotechnology enables an existing substance to be changed to work better, such as making titanium dioxide particles smaller in sunscreen which makes the white pigment disappear. In other products, nanotechnologies can be used to increase the number of substances that can be used in a product such as increasing the amount of vitamins or growth promoters. In the future, nanotechnologies may be used to prevent the greying of hair and even baldness.

Potential issues arise around the concern that nanoparticles of particular substances may become more toxic at a small scale than they are in a larger particles. There are also questions being asked about whether it is potentially possible for nanoparticles to get through the skin's barriers and create "free radicals" that damage cells. Some people have raised concerns that the existing safety standards were not designed with nanotechnologies in mind. The industry responds by saying the safety standards applied in all circumstances are today's standards and they evolve with the emergence of new information. The cosmetics industry also says that many of the products alleged by other organisations to contain nanoparticles actually contain particles that are larger, so people have a perception that the use of nanotechnologies in cosmetics and personal healthcare is more widespread than it actually is. The European Scientific Committee is currently examining safety concerns around nanotechnologies used in cosmetics.

- Key positive reactions to the use of nanotechnologies in personal healthcare and cosmetics
 - Panellists were fairly positive about the potential of nanotechnologies in personal healthcare and cosmetics. Although some (particularly men) felt that the potential safety risks meant that they would be unlikely to try a product that they knew had been developed using nanotechnologies, many thought that they would be more likely to try a nano-enabled product as it was something new and therefore that nanotechnologies could be a specific selling point.
 - Using nanotechnologies in personal healthcare was thought to have the potential to deliver more consumer choice and products that work more effectively. Participants were excited about the potential for nanotechnologies in the manipulation and delivery of materials, for example in painkillers or anti-wrinkle creams.

- However, positive reactions tended to be on the assumption that products were safe. Panellists felt that they would expect anything that came onto the market to have been tested for safety.

“You don’t doubt anything you pick up off the shelf”

- After discussion of the potential benefits and issues of using nanotechnologies in personal healthcare, many participants said that they would be at least as, and possibly more, likely to pick up a nano-enabled product out of curiosity.

- Key negative reactions and issues raised about the use of nanotechnologies in personal healthcare and cosmetics

- Participants were worried that doubts had been expressed about the suitability of safety tests for nanoparticles and nanomaterials. Although they accepted that the cosmetics industry felt products were safe, and were to some extent reassured by this, they were slightly cynical over whether this meant that products actually were safe. They thought that there was the potential for larger companies, to ignore safety concerns to pursue profit. This was not felt to be an issue exclusive to personal healthcare, but it was felt that there is a lot of potential profit in new cosmetic treatments and that therefore the temptation might be correspondingly greater for companies working in this area.

“You do not allow anything onto the market without safety tests.”

“If the people who are developing it aren’t sure it’s safe then that’s frightening.”

- Many said that they would apply “common sense” when selecting products and in weighing up whether to use ones utilising nanotechnologies, as they would with other new products. However, there were doubts expressed over how far it would be possible for consumers to make this sort of informed choice when they were not sure:
 - Whether the product utilised nanotechnologies (if there was no labelling)
 - What the potential risks were – it was acknowledged that the Panel were in a more privileged position than most consumers, with regard to the information they had received
 - Whether the existing safety tests were adequate – a product might have passed these but if the tests were inappropriate for nanomaterials there might still be safety concerns
 - There was some resentment expressed about the onus being placed on the consumer to think about risks.

“Why should we have to think about that? Someone else gets paid to think about the risks from my point of view.”

- Participants were interested in the differences between the product lead times for cosmetic and medical treatments. They felt that to some extent the risks might be comparable between the two if a similar delivery method was used (e.g. a cream), for example:
 - The risk of allergies
 - Any risk associated with the different sizes of nanoparticles as compared to their larger counterparts

“If an antibiotic cream is taken in through the skin and a cosmetic cream is taken in through the skin, why does it take ten years to develop a new drug and something like five years to develop a new cosmetic?”

- Finally, participants were worried that nanotechnologies could become a marketing tool designed to make them pay more for products, without necessarily delivering any extra benefits.

“I think one of the dangers is that when everyone starts advertising new nano products, it will become a buzz word that won’t actually mean anything.”

- Key questions and areas for further information about nanotechnologies and personal healthcare and cosmetics

Participants were keen to know more about the following issues. These were asked in plenary by nominated spokespeople from each breakout group, and answered by Clive Roberts and an industry spokesman:

- Whether products using nanotechnologies will be tested on animals (i.e. whether using nanotechnologies will increase the number of animal tests)
- The independence of the safety assessors who sign off the products – whether they work for the company developing the product, or whether they are independent. On receiving the answer that the assessors often work for the same company, levels of concern increased (although Panellists understood that the safety assessor put their own name to the product, they were worried about possible coercion or pressure on the assessor from the product marketing and development teams)
- Whether there are regulations in place that mean that consumers have to be told if a product has been developed using nanotechnologies. There was some debate over whether the fact that there is not is necessarily a bad thing: some feel that it might worry people unnecessarily. There was also interest in the potentially different attitudes

of different societies to nanotechnologies: for example, the fact that the “nano” message could be used in marketing in some countries, but as a warning in others.

- Whatever the status of the safety tests and regulations in the UK or EU, there were worries that it would still be possible to buy products unknowingly, for example over the Internet that had either not been tested, or not to the same standards.

Session 3: Nanotechnologies in food and food technology

After lunch, participants were again asked to move into three self-moderated groups and spend time discussing the potential applications and benefits of using nanotechnologies in food, and any possible issues and implications they could think of.

Benefits initially identified by participants were:

- The possibility of increasing shelf life through more efficient packaging (it was thought that this would have potential applications in getting food aid to disaster zones as well as for ordinary consumers)
- Adding beneficial vitamins and compounds to foods to give them extra goodness
- Enhancing flavours
- Removing some of the toxins that can make food poisonous, for example in mushrooms or red kidney beans

Possible issues were:

- Some were very unsure about the idea of “messing with” food, and thought it was unnecessary.
- Doubts were expressed about potentially changing the appearance of food, for example the colour of fruit and vegetables
- The need for choice was emphasised – participants did not want nanotechnologies in food to be imposed on them

Dr. Vic Morris from the Institute of Food Research then delivered a presentation about the use of nanotechnologies in food.

Witness: Dr. Vic Morris, Institute of Food Research – Nanotechnologies and Food

Vic Morris gave us an overview of products that already used nanotechnologies with food and suggested ways they may be used in the future. Nanotechnologies may increase the shelf-life of food by protecting it from harmful bacteria. One way of doing this is by developing packaging which prevents air getting to fresh food by using nanoclays to slow the flow of gases. There are also other products that have anti-bacterial properties developed through nanotechnologies, particularly using nanosilver, which include chopping boards and fridges. There are also plans to develop 'intelligent packaging' which will be able to detect whether food has gone off. There may also be edible coatings developed to prevent fruit and vegetables from spoiling.

Nanotechnologies could be used to enhance food by increasing the number of nutrients they contain, improving people's diets. 'Nanoencapsulation' could also be used to develop targeted delivery of molecules within food to the places they are needed in the body. Vic also outlined the possibility of nanotechnologies to change the taste, aroma or colour of food.

Vic described the potential issues around using nanotechnologies in food, which include potential toxicity, bioaccumulation and effects on the environment. Labelling can also be an issue as the 'nano' brand could be used carelessly, meaning a detailed definition would be needed for each product. However, he did reassure that the food industry is very heavily regulated in terms of the safety of any new products and that the future of nanotechnologies in food ultimately depends on consumer demand and choice.

Following this, participants moved back to breakout groups to discuss in further detail their positive and negative reactions, and any areas for further information.

- Key positive reactions to the nanotechnologies in food presentation

- Participants' reactions to the idea of using nanotechnologies in food were on the whole perhaps more positive than might have been expected given some of the comparisons that had been drawn, and knee-jerk reactions (for example, comparing nanotechnologies to GM)
- **Food storage and packaging** – participants were positive about the potential for nanotechnologies to provide increased antibacterial properties in materials, and thought that this would have cross-sector applications (e.g. in hospitals). They also liked the idea of colour-coded packaging to let you know when foods were going off, and the possibility that packaging could make foods last longer. All of these they thought would decrease waste, which would help them save money and be good for the environment.

"It will help us – how much food do we waste and throw away because it's gone off?"

"It's fascinating about the colour coding. How many times do we throw things away because we're not sure? So this could save us a lot."

- **Changing the properties of foods** – there were positive reactions to this, and participants thought that the potential applications might be particularly helpful for children's food – making foods more attractive to children, increasing the range of nutrients in foods they ate, and helping to "de-junk" children's diets.

"We're reading so much in the papers about junk foods. Would it be possible to de-junk it, so that kids can still eat burgers but it would be doing them good?"

"I don't eat fruit so I'd love to be able to take something in a drink that would taste nice and give me all the good things in it."

- It was also thought that nanotechnologies might cut down on the need for pesticides and preservatives. Although it was accepted that some people might not like the idea of this, others felt that the issues for nanotechnologies were not necessarily different from the treatments currently given to foods, and which consumers tend to accept.

"It's food looking after itself, and not because we've treated it with another chemical."

- Key negative reactions to the nanotechnologies in food presentation

- Although there was much that participants were positive about, there were also some areas that they were unsure about, or that they raised as potential issues:
- The issue of whether these applications have been sufficiently tested was raised
- Participants were again keen to make sure that the environment did not suffer (for example, that nano-enabled packaging was not any more harmful to the environment)
- The issue of possible transfer of nanoparticles into food was raised, for example if nanosilver was used to coat the inside of a fridge.
- Some wondered whether nano-enabled foods would have any harmful effects on the body, or whether they might have more minor effects such as not being digested as well, or increasing allergies
- Allied to this, the idea of bioaccumulation was a worry once participants had heard about it.
- There was an assumption that nano-enabled foods in particular would be a "difficult sell" to the general public. This was felt to be because people are nervous about having changes made to their food, because people may be reluctant to try new things, and because of the previous example of GM (and the likelihood that the media would run similar stories about nanotechnologies in food)

"I think this will be the hardest one for the public to swallow, but it could be the one that does the most good."

"People have strong ideas of what they eat... they get set in their ways, so it will be hard to get people to try new things."

“Anything to do with food and the manipulation of it worries people – there were all the things with the GM crops and lots of people were against it. To push it you need the backing of the press as they whip up a frenzy.”

“The media will either be a big help or a big hindrance in this.”

- Indeed, some participants did display an instinctive rejection of nanotechnologies in food, feeling that it was “not natural” and that they did not want to buy such foods. Potentially changing the taste and appearance of foods was particularly disliked by some (although others felt that there were potentially beneficial aspects to this, for example in making healthy food more appealing to children).

“But that’s about engineering our food, it’s not natural.”

“I don’t think we want to tamper with our food.”

“Changing the taste and colour – oh no, I don’t like that, I think that’s unnatural, totally unnatural – playing with people’s minds.”

- Participants did not want nanotechnologies to be imposed on consumers. They believed it should be a choice. When asked whether they themselves would choose a food using nanotechnologies over one that did not, there was a spectrum of opinion: some said that they would because of the novelty value, others said that it would depend on factors such as the price and what the food promised to deliver, and others felt they would never buy a food using nanotechnologies. The problem of telling consumers that nanotechnologies were being used while the issues are still unclear and the public is still largely uninformed was again raised, with the idea of a “risk rating” similar to the energy efficiency rating used on fridges being suggested.
- The issue of unwittingly buying foods that were potentially not produced to the highest safety standards, for example over the Internet, was again raised.
- Finally, some participants disputed that there would be any benefits nanotechnologies could deliver in food that would not already be accessible to people who took care of the way they chose, shopped for, cooked and stored food. This was felt to have been good enough for many years and so these people did not see a reason to change their habits.

“I like to buy fresh every week anyway – I don’t think I’ll change my shopping habits just because of new packaging.”

“I’ve never had a problem with my fridge – I don’t need an anti-bacterial.”

Key questions and areas for further information

- Participants wanted more information about how nanotechnologies “get into” food
- If foods were preserved for longer, would they lose their natural vitamins?

“Will we lose the natural goodness by adding all this nano stuff to preserve it?”

- Would there be consumption guidelines for nano-enabled foods, and what might be the consequences of not following these?
- Might there be issues with packaging utilising nanotechnologies, in the same way as there was with cling film reacting with fat?
- Could allergies be created or exacerbated through using nanotechnologies, or would there potentially be issues for people on special diets (e.g. diabetics)?
- If nano-enabled foods made specific claims (such as helping people to lose weight), how would these claims be tested and monitored?

Session 4: Nanotechnologies and consumer products

Participants then moved into self-moderated groups again and had a short discussion about the potential applications and benefits of using nanotechnologies in consumer products (which were defined as being any products consumers might buy or used that had not been covered in the previous presentations), and any possible issues and implications they could think of.

Benefits initially identified by participants were:

- Modifying materials and substances to make them more durable – for example, making a hair dye that lasts longer, or tyres that wear out more slowly
- Miniaturising existing devices, e.g. sat nav devices that could be carried around with you
- Making processors faster – and hence making phones, computers, gaming and communications faster and more sophisticated

Possible issues were:

- The affordability of new nano-enabled technologies, and how long it would be before ordinary people could access them
- Whether nanotechnologies will mean technology progresses at a faster and faster rate

Professor Jeremy Baumberg from the University of Cambridge then delivered a presentation about the use of nanotechnologies in consumer products.

Witness: Professor Jeremy Baumberg, Cambridge University – Nanotechnologies and Consumer products

Jeremy gave a useful projection of how he sees nanotechnologies being used in the future in products that we will use for everyday living such as fuels, transport and energy supply, but also to enhance our entertainment, such as e-books. Jeremy explained that some nanotechnologies will develop out of already existing technology ('evolutionary') following a current trend such as enabling products to become smaller and smaller, but other nanotechnologies will be 'revolutionary' and actually completely change the direction of development. Nanotechnologies may enable us to make much more efficient use of our resources such as increasing our energy efficiency and developing locally sustainable living. However, these advances will only be possible alongside developments in other technology as nanotechnologies are really only one small enabling component.

Following this, participants moved back to breakout groups to discuss in further detail their positive and negative reactions, and any areas for further information.

Reactions at this stage tended to mirror the benefits and concerns already raised. Few new benefits, concerns or questions were raised at this stage.

- Key positive reactions to the nanotechnologies and consumer products presentation

- The examples used in the presentation were very wide-ranging, which reminded participants of their initial reactions to the concept of nanotechnologies: it was felt that they offered *"something for everyone"*.
- It was hoped that nanotechnologies would make consumer products cheaper (or offer increased performance at the same price).
- Hopes that nano-enabled consumer products could be used to benefit the developing world were again expressed.
- Participants were again extremely positive about the potential health applications of nanotechnologies in consumer products – for example, mobile phones being used to monitor health in those living alone, or for the user.

"For instance, if there was a process in nanotechnology - you could desalinate water on a huge scale and purify water on a large scale – that could benefit Africa and even Europe."

"One of the things that impressed me most, the idea of being able to walk into my GP and be able to say my blood pressure has gone up or even my cholesterol level has gone up to 7.8 – rather than the GP just saying, you're just making it up."

- Participants again raised the potential environmental benefits greater efficiency might bring – such as cutting down on the number of batteries used.

“That seems a really interesting proposition – what about people who go hiking or mountain climbing and it generates energy for their mobile phone or something.”

- Key negative reactions to the nanotechnologies and consumer products presentation
 - The issues of safety and regulation were again raised.
 - Discussions on miniaturisation reopened the debate about whether or not this would increase the probability of an overall increase in surveillance.
 - Again, the question of whether products would be regulated worldwide, or whether imported products might not be subject to the same safety standards, was raised.

- Key questions and further information needed
 - The issue of entering into competition with other countries was again raised, with participants being aware of the need for caution, but also keen for the UK not to lose its place in the race to develop nanotechnologies.
 - Questions were again asked about the nature and extent of regulation.
 - Participants were curious and excited about new product developments that might be expected in the future, and the possible timescales for these, and some time was spent in discussion of what these could be.
 - There was further questioning about how nanotechnologies could help the environment, this time by reducing dependency on fossil fuels.

- Individual exercise

Participants were asked to fill in the same individual exercise sheet as they had completed on the previous day at this stage. Again the aim was to assess individual levels of interest, concern and opportunities seen in nanotechnologies, and the impact participants thought they would have on consumers, but also to see whether views had changed at all. Again, for each question, participants rated themselves on a scale of 1-10 based on the initial information they had at that stage, with 1 being the least and 10 the most.

 - Interest in nanotechnologies: In response to the question “How interested are you in the idea of nanotechnologies?” answers ranged from 8 to 10 (average 9 – 2 more than on the previous day)
 - Opportunities seen in nanotechnologies: When asked “How much opportunity do you see in nanotechnologies?” answers ranged from 7 to 10 (average 9 – 1 more than on the previous day)
 - Concern about nanotechnologies: The question “How cautious do you feel about nanotechnologies?” drew answers ranging from 4 to 9 (average 6 – 0.5 less than on the previous day)
 - Impact nanotechnologies will have on consumers: When asked “How much impact do you think nanotechnologies will have on consumers?” answers received ranged from 6 to 10 (average 8 – 1 less than on the previous day)

The day ended with participants again preparing a summary in their breakout groups. Across the two groups these presentations covered the following:

- Key opportunities:
 - “Endless” – too many to explain
 - The leaps in progress that nanotechnologies will enable in product development and efficiency
 - The health applications – e.g. earlier diagnosis of illness
 - More consumer choice
 - Possible reductions in waste with associated savings for consumers and benefits to the environment
 - Nanotechnologies represent an opportunity for the UK to take the lead in technology again, as it did in the Industrial Revolution

- Key uncertainties and issues:
 - Will regulation and safety checks be adequate? And will they be applied internationally?
 - Will the new products and technologies be within the reach of everyone?
 - Will the research and its resultant benefits be worthy of the amount that it will cost?
 - Economically, the UK might be no better off if something was invented here and was then able to be produced more easily and cheaply abroad
 - Bioaccumulation – what potential is there for this?
 - How much choice will consumers have about whether to use products containing or utilising nanotechnologies?

- Key further information needed:
 - More information about the risks and what is being done to ensure safety
 - More education of consumers and the general public about the whole issue in order to help them make informed choices
 - Potentially a central point at which consumers can access information about nanotechnologies

3.3 Day Three: Controlling nanotechnologies and the summing up process

Key insights:

- Participants were surprised and concerned about the lack of controls on nanotechnologies and nanomaterials, and the fact that there is currently no nano-specific regulation in place. From what they had heard about the potential side-effects and long-term effects of nanotechnologies, they had assumed that there would be a need for this
- They felt such regulation should be looked at as a matter of urgency, and that the Government and EU should strictly follow guidance from scientists working in the area of risk assessment with regard to nanotechnologies
- They accepted the need to balance regulation with creativity and innovation, and were keen that the UK take a leading place in developing nanotechnologies, but felt that the balance of consideration should come down in favour of public safety
- Participants did not trust industry to regulate itself and were keen that there be some kind of external regulation
- They felt that the issue of informing consumers about nanotechnologies was a difficult one, as any information about nanotechnologies having been used in developing a product would need to be backed by a programme of consumer education through mass media. Informed choice was about having the background information necessary to decode product labels, as well as being told whether a product used nanotechnologies

3.3.1 What the day involved

The aim of the day was to enable participants to sum up their views. To do this, they were given some further information on the control and regulation of nanotechnologies, and then asked to sum up their views on:

- The main opportunities nanotechnologies present
- The main issues raised by nanotechnologies for consumers
- The main uncertainties, and areas on which they would like further information
- Any “no-go” areas
- The controls they think should be in place on nanotechnologies

The day opened with participant presentations, following which the answers received overnight from the cosmetics industry were delivered to the Panel. A presentation was then delivered on the ways in which nanotechnologies are currently being controlled and regulated, following which Panellists were asked for their views on what controls should be applied. The day closed with a summary discussion and feedback session.

3.1.2 Presentations and deliberations

Session 1: Controlling nanotechnologies

Dr. Qasim Chaudhry from the Central Science Laboratory delivered the final presentation of the Panel, which was about the ways in which nanotechnologies are currently being controlled and regulated.

Witness: Qasim Chaudhry, Central Science Laboratory – Current controls on nanotechnologies

Qasim outlined a number of health and environmental concerns about the impacts of nanotechnologies which have already been identified. These included concerns about the impact nanoparticles may have on humans and also what effect they will have when they make their way into the environment. As the particles are so small, any nanoparticles in products that are disposed of in landfill sites are likely to seep into the soil and be taken up by plants, which may then have an impact on that ecosystem. Qasim explained that risk can only occur when hazard is combined with sufficient exposure and that both of these elements need to be fully investigated before full risk can be calculated.

Qasim explained that currently there are conflicting views on what the way forward should be on regulation, arising from competing interests. For example, some NGO's are calling for a complete moratorium on development of nanotechnologies whilst industries claim that there is no need for regulation. The regulating bodies themselves are keen to have evidence of the risks before they impose regulations, but this evidence is currently in short supply. This means that it is difficult to enforce and so regulatory bodies prefer to encourage industry to self-regulate. This is the approach adopted by the EC in 2004 which asks member states to use existing safety regulations to their maximum and amend these when appropriate. There is currently no nano-specific regulation in the UK, EU or USA, which can cause problems as where they come under existing regulations can be debatable. Currently there is a disagreement between the scientific community and industry over whether substances which have been declared safe previously and are now being used at the nanoscale are actually 'new' substances and therefore subject to new testing. However, there are broad safety laws such as The General Product Safety Directive which ultimately puts the responsibility on to the producer to ensure that a product is safe before it becomes commercially available.

Qasim called for an internationally harmonised framework for Nanotechnology on risk governance to be developed that will ensure new products do not fall through the gaps in legislation.

- Reactions to the presentation: how the actuality compares with assumptions
 - There were mixed reactions to the presentation, based on participants' existing assumptions about the degree of control and regulation being applied to nanotechnologies.
 - Participants were on the whole surprised that there were not more safety regulations when experts had expressed concern about there being potential issues with regard to nanotechnologies, and in particular about the different properties of nanoparticles in comparison to their larger-scale counterparts, especially as products are already on the market.
 - Participants were indignant that industry was attempting to claim, on the one hand, that nanomaterials were offering something new and different because of their different properties, and on the other hand that no new regulation was needed because they were not a new material.

“It surprises me that there isn’t any nano-specific regulations and there are products out there.”

“I’m surprised that nothing’s been started yet.”

“We’re using products that really we don’t know anything about – the bomb’s gone off and we’re still not down the bomb shelter.”

- Many said that they did not understand why the regulations could not be changed to be applicable to nanotechnologies.

“Why can’t they say there isn’t any nano specific law so you can’t put these things on the market?”

- However, some people had assumed that no regulation at all had been taking place, or that the issue of nano-specific regulations was not being addressed, and hence were reassured by the fact that work was taking place in this area, even if it is at an early stage.
- Some participants had also not been aware of the extent to which materials and substances are currently regulated and were pleased to find that they were reasonably tightly controlled, even if the legislation had not yet been adapted to cover nanomaterials.

“I was quite pleased initially that there was so much rules and regulations already – but some of it doesn’t apply as nano is a new technology.”

- Reactions to the presentation: Views on the adequacy of regulation

- Participants were clear in their view that regulations needed to be looked at and tested for their applicability to nanomaterials. They felt that the safest position would be to consider nanomaterials as new materials and proceed on that basis. Although they accepted that industries did not want to consider nanomaterials as new, they felt that the needs of product safety overrode this.

“I can’t see why we can’t say we’ll look at it and test it properly – head forward as if we’re going to go for it and then when the test results come back say go ahead and start producing.”

“That seems to me that a good default should be that all nano should be considered as new.”

- Participants were divided on the specific conditions that should be applied with regard to any regulation, for example whether it was vital that nanomaterials should be able to be destroyed. Some felt they should, whereas others were keen not to set specific conditions and ask things of nanomaterials that were not asked of existing materials.

“You need to find out if it’s toxic first and then prove that it won’t leach out.”

“But there’s so many things already that we can’t destroy.”

- Participants also felt that there should be more controls on advertisers and the claims they are able to make with regard to nanotechnologies. They felt that regulation about when they were and were not allowed to say a product was developed using nanotechnologies (and when they would be forced to say that it did) was needed.

“It worries me that they can put on there that this is nanotechnology and then it isn’t – I think that’s completely false advertising, it’s surprising that is allowed.”

- Views on how regulations should vary between the different areas were considered, with free nanoparticles thought to need more regulation than fixed nanoparticles, and areas where nanoparticles came into contact with the human body thought to need more regulation than areas where they were contained in an appliance outside the body.

- Reactions to the presentation: Who should regulate nanotechnologies?

- Participants were alarmed at the extent of self-regulation at the moment, citing the reluctance of industry to class nanomaterials as new materials as an example of how they do not view them currently to be acting in the best interests of the consumer. They were therefore vociferous in their desire for some form of external regulation, rather than self-regulation. They said that they would not be likely to believe an industry-controlled assurance of safety, such as a quality mark. Even if industry was following the safety tests, they believe that the applicability of safety standards to nanotechnologies makes this a doubtful reassurance.

“The people in the industry have just got their people.”

“Wouldn’t believe in it. How can they put that quality mark on when they’ve no way of testing it?”

- Panellists were keen to involve the Government, independent bodies, and scientists in regulating nanotechnologies. Suggestions included the Government involving scientists

and industry in setting standards, then monitoring and assuring companies' own safety tests before allowing products onto the market, an independent body set up to regulate nanotechnologies, or an independent body set up to regulate nanotechnologies in each of the areas considered.

- They also wanted to be sure that safety checks would be applied internationally, fearing that otherwise they might be meaningless in a global age where products can be sourced internationally.

"We have to have an international regulation body, because you can order things on the Internet and get them from India."

- Reactions to the presentation: Key information still needed

- Panellists were keen that an overall strategy should be developed urgently with regard to nanotechnologies and their use, and wanted to know to what extent this was happening.

"It's like going out blindly into a blizzard or actually sitting down with a map and thinking about where you are going to go."

Session 2: Summing up

After lunch, participants entered a final summing-up session, within two moderated breakout groups, where they brought together their views at the end of the Panel.

Views about nanotechnologies in comparison to other technologies

Participants were divided over whether they saw nanotechnologies as being essentially different to other technologies. On the whole, nanotechnologies were thought to be different because they are:

- Comparatively new, meaning that the long-term effects are yet to be established
- Difficult to understand, leading to likely confusion among users
- Extremely far-reaching in their implications.

"Other products have been on the shelf for ages so we'd know if there was anything wrong with them."

"But they still don't really know what will happen to it in 30-40 years time."

"I don't think they are different – but you need to de-mystify things."

They accepted that many of the issues raised with regard to nanotechnologies – for example toxicity, environmental effects, the potential to be used for harm – also existed for other technologies and

applications of these, without necessarily affecting the extent to which they used them as consumers. They were, however, keen that nanotechnologies should be assessed to see whether they brought any *new risks* (whether in terms of nature or severity).

Participants also varied in terms of whether they thought they would have held different views had they not formed part of the Panel. Many thought that they would not have known enough about nanotechnologies to have a view had they not been, which they felt had implications for other consumers.

“If I hadn’t been on this panel it wouldn’t have made any difference to me – apart from the food, that would have been my main worry.”

There was a certain amount of fatalism in regard to what consumers could potentially do to control nanotechnologies. Participants were realistic that nanotechnologies would be used in new products.

“It seems we’re going to have this new technology whether we like it or not.”

Views about nanotechnologies in different areas

Whether participants were personally concerned about nanotechnologies or not, they were on the whole agreed that the tightest controls were required with regard to medicine and food (although they were also more willing to try experimental or unproven applications in the area of medicine), as these are areas where nanoparticles may be ingested. Personal healthcare and cosmetics came next, as consumers may apply nanoparticles to the skin. Consumer products were thought to need the least tight controls, although participants were still keen that there should be regulation in place.

“If you were dying I don’t think you would be so cautious – you’d try anything.”

“Anything outside the body is OK, but when it comes to food and medicine and ingesting things. That’s more of a worry.”

The use of nanotechnologies was not always thought to be necessary, and in some areas participants sought a traditional or low-tech solution to a problem, if the benefits of using nanotechnologies were doubtful or limited.

“I’d rather clean my fridge than have a nanosilver fridge.”

The information that should be provided to consumers

This was thought to be a difficult issue because:

- Consumers may not know anything about nanotechnologies and therefore may be confused or frightened by the word, possibly putting them off something that may be beneficial or not harmful

- However, if there may be long-term effects, it is unethical not to inform them

These issues were felt to be made more complicated because consumers are likely to have a variety of informational needs (they will vary in what they know to start off with, and in the extent they are likely to be interested or want to be informed about the issues). The word “nanotechnologies” was also thought to sound difficult, which might put people off or worry them.

“Surely it depends on what they know to start with – it’s about being informed to start with.”

“It would just confuse people more – they’d just say, I don’t know what that is so I think I’ll avoid that.”

“I think the worst thing is this word nanotechnology – it frightens the life out of me.”

Participants were clear that, if consumers were to be informed that products had been developed using nanotechnologies, this had to be done in tandem with informing them about what the term meant and about the possible benefits and implications. If this was not done, it was felt that there would be an informational vacuum which might be filled by scare stories.

Participants also thought that some people would be happy not to know anything about whether products were nano-enabled or not – they acknowledged that the Panel had piqued their interest and that most people would not be in this position, so would be less likely to have a view.

“We find it interesting as people to find out about this, but if we hadn’t we would have been quite happy carrying on with their lives not knowing anything.”

Panellists thought that a symbol or mark on the packaging would be sufficient to inform people that the product was nano-enabled, but that the contextual information was best delivered through mass media such as newspapers and TV.

Protecting consumers

Acquiescence to the continued use of nanotechnologies was felt to be subject to safety checks and safety monitoring. Panellists were not demanding a 100% safety guarantee, but wanted to be sure that that:

- No new products would be introduced to the market without undergoing a full risk assessment to the best of current knowledge
- Development and further use of any materials and products that did prove to be suspect would be halted until further tests were carried out to give more information

- There would be no attempt on the part of Government or corporations to hide potential issues from the public
- Participants were often accepting of a certain level of risk if they saw a benefit – for example, most people had had a mobile phone before they had been proven safe.

4. Summary of overall position with regard to nanotechnologies

Participants were very excited about the potential that nanotechnologies offer, but wanted to balance the potential benefits against the potential risks. It concerned them that so much was currently unknown about nanotechnologies and their potential long-term effects. They accepted that they had happily used other technologies whose long-term effects were unknown – for example mobile phones – but felt that nanotechnologies were different, both because of their nature (the fact that you cannot see nanoparticles was felt to arouse suspicion), and because of their wide-reaching implications, which potentially may affect every area of their lives.

Given that much remains unknown about the long-term safety issues, Panellists were keen that consumers should be offered a choice about whether or not to buy nano-enabled products, and that nano-enabled products should not be forced onto consumers. They were especially clear that consumers should be informed about food and cosmetic products using nanotechnologies, as they were concerned about the potential toxicity issues. They felt that the most sensible way of informing consumers was through labelling, although they acknowledged that in isolation most consumers are unlikely to understand what this means. They therefore thought that labelling should be combined with a public information campaign through mass media, so that consumers are able to interpret labelling and make an informed choice.

This said, participants were keen to move ahead with developing nanotechnologies. They recognised that a balance had to be drawn between the potential risks and encouraging innovation and creativity. They understood the potentially enormous economic benefits of nanotechnologies and were keen that the UK should secure its share of these, which they felt might mean a certain amount of moving ahead before the risks were all established. Not doing so would mean that the UK might lose out economically, while still not obtaining immunity from any negative effects – as the products would be being developed in other countries in any case and this would inevitably mean that they would make their way onto UK markets. Panellists felt that by moving ahead and applying a certain amount of caution, the UK would be able to secure the advantages of both the economic benefits and the ability to set regulations.

“To ignore it might be the equivalent of saying in the 18th century, we don’t want anything to do with the Industrial Revolution.”

“We have to be involved – the UK can’t afford to say no to nano because the rest of the world will carry on and we’ll be buying it in.”

“It would leave us vulnerable to technology that we can’t regulate.”

However, Panellists were clear that there had to be some kind of regulation in order to protect consumers, and that they did not view a self-regulated approach by industry to be adequate to do this. They were keen to listen to the input of scientists working in the area of risk and regulation, and also keen that Government and other regulatory bodies such as the EU should listen to scientists working in these fields while setting standards, in order to make sure they were adequate to cope with the different properties of nanomaterials. They were clear that the existing situation – where industry is free to make positive claims with regard to the novel benefits of nanoparticles, while denying that they may have any new negative or undesirable properties – should not be allowed to continue.

5. Appendix 1: The agenda

Citizens' Panel on nanotechnologies

Discussion guide – Final version

Thursday 29th November

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| Morning session: Introduction to the panel and to nanotechnologies | |
| 9.45-9.50 | Initial introduction and welcome (Opinion Leader) |
| 9.50-10.15 DG01 | <ul style="list-style-type: none"> • Split into two breakout groups • 5 minutes: Introductions: name, where from, what would they be doing if they weren't here today, any children, work/study etc. • 5 minute flipchart exercise: Associations with the word "technology" – flipchart on 1 sheet • What do they think the word means (what is included in the term)/what do they think the word doesn't mean (what is not included in the term) • How much do they generally feel they know about technology <ul style="list-style-type: none"> How confident do they feel with it How much do they feel they know about it • Recent technological developments they can think of • And reactions to these: (record positive/negative) • What new opportunities do new technologies present (probe on social, environmental, health, ethical) <i>Record on sheet</i> • And are there any downsides? <i>Record on sheet</i> • Reassure group that all these issues will be revisited later but that for now you want to look at what we mean during this event when we talk about technology |
| 10.15-10.20 | Remaining in breakout groups Introduction to technology from briefing notes, plus specific definition of nanotechnologies (Opinion Leader) |
| 10.20-10.40 DG02 | <ul style="list-style-type: none"> • Remaining in breakout groups • Participants have opportunity to respond/discuss • Probes: • What do they think of this definition of technology • How does it fit/not fit with their initial discussions • Initial reactions to the concept of nanotechnologies (reassure that this will be explained in greater depth later today?) |

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| | <ul style="list-style-type: none"> • What are their initial reactions? (record both positive and negative) • Any initial questions • Back to plenary |
| 10.40-10.50 | Explanation of why Which? is holding a Citizens' Panel on Nanotechnologies (Sue Davies, Which?) |
| 10.50-10.55 | Explain Panel process/ground rules/agenda/witnesses for next 3 days (Opinion Leader) |
| 10.55-11.10 | Break |
| 11.10-11.20 | Scientific overview presentation (Nicole Grobert) |
| 11.20-11.45 DG03 | <ul style="list-style-type: none"> • Split into 2 breakout groups • Initial reaction • What was clear about the presentation/what did they find easiest to grasp • And what is more difficult to understand • What did they react positively to • And what did they react negatively to • What would they be interested in finding out more about • Individual questions: each person to write down something they would like explained further or something they would like to find out more about <i>Participants to record on pre-printed slips</i> • Nominate a spokesperson to ask the questions • Back to plenary |
| 11.45-12.00 DG04 | <ul style="list-style-type: none"> • In plenary: Q&A • Spokespeople to read out questions / experts to answer (if possible) • If time: how does this change/confirm initial views? • Anything that is still unclear? • Anything else they would like to know at this stage? |
| 12.00-12.10 | Policy overview presentation (Richard Jones) |
| 12.10-12.30 DG05 | <ul style="list-style-type: none"> • Split into 2 breakout groups • Initial reactions • Check understanding • Views on policy, based on the information they have so far • What role do they see the UK taking on policy? • Individual exercise: based on the basic information they have so far, on a scale of 1-10: <ul style="list-style-type: none"> How interested in the concept of nanotechnologies are they personally How much opportunity do they personally see in nanotechnologies How cautious do they personally feel about nanotechnologies How much impact do they see nanotechnologies as having on consumers in general? • Where did people say they would like the balance to be drawn and why • Nominate a spokesperson to feed back |

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| 12.30-12.40 DG06 | <ul style="list-style-type: none"> • In plenary: Q&A • Spokespeople to read out reactions? / experts to answer (if possible) • If time: how does this change/confirm initial views? • Anything that is still unclear? • Anything else they would like to know at this stage? |
| 12.40-1.00 | In breakout groups Participants prepare a summary of key opportunities/uncertainties/issues/ and further info needed |
| 1.00-2.00 | Lunch |
| Afternoon session: Nanotechnologies in practice | |
| 2.00-2.10 | Applications overview presentation (Richard Jones) |
| 2.10-2.50 DG07 | <ul style="list-style-type: none"> • Split into 2 breakout groups • What was clear about the presentation/what did they find easiest to grasp • And what is more difficult to understand • What stood out • How do they react to applications (Record positive/negative reactions) • Any questions or areas that lack clarity • What more would they like to know • Group to come up with a group list of 5 questions to ask in plenary • Nominate a spokesperson to ask the questions |
| 2.50-3.10 DG08 | <ul style="list-style-type: none"> • In plenary: Q&A • Spokespeople to read out questions / experts to answer (if possible) • If time: how does this change/confirm initial views? • Anything that is still unclear? • Anything else they would like to know? (e.g. any other ways in which they are wondering whether nanotechnologies could be applied?) |
| 3.10-3.25 | Break |
| 3.25-3.30 | General Issues and implications overview presentation (Richard Jones) |
| 3.30-3.40 | General ethics and environmental implications overview presentations (Rob Doubleday) |
| 3.40-4.20 DG09 | <ul style="list-style-type: none"> • 2 breakout groups • 5 mins: Individual response to presentation – how do they feel towards nanotechnologies now? Record on sheet of paper • What specific issues have these presentations raised for them personally? Record on sheet of paper • What did everyone put down for those two issues |

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| | <ul style="list-style-type: none"> • What does the group as a whole think to this? - Discussion • What stood out • Record positive/negative reactions • Any questions or areas that lack clarity • What more would they like to know • Individual questions: everyone to write down a key concern or something they would like to find out more about |
| 4.20-4.40 DG10 | <ul style="list-style-type: none"> • In plenary: Q&A • Spokespeople to read out questions / experts to answer (if possible) • If time: how does this change/confirm initial views? • Anything that is still unclear or they would like to know more about? |
| 4.40-5.00 | In breakout groups: Participants to update/add to their summary |

Friday 30th November

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| Morning session: Nanotechnologies, medicine and personal healthcare products | |
| 9.45-10.00 | Participants present yesterday's summary (1 participant from each breakout group) |
| 10.00-10.15 DG11 | <ul style="list-style-type: none"> • Split into 3-4 small groups within plenary room • Moderator to explain that we will now be looking at the issue of nanotechnologies in medicine. Based on the evidence they have heard so far: • In what ways might nanotechnologies be useful in this area (Each small group records on sheets) • Can they think of anything they have heard which might be a benefit of using nanotechnologies in this area (Each small group records on sheets) • And can they think of anything they have heard which might raise issues about using nanotechnologies in this area (Each small group records on sheets) • Each group feeds back one possible benefit and one possible issue |
| 10.15-10.25 | Medical applications presentation (Clive Roberts) |
| 10.25-11.00 DG12 | <ul style="list-style-type: none"> • Split into 2 breakout groups • Initial reactions to the presentation • What stood out • Record positive/negative reactions • Any questions or areas that lack clarity • What more would they like to know • What do they think the effects of using nanotechnologies in medicine will be (including social) • Did any of what they heard change their views |

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| | <ul style="list-style-type: none"> • What would they think about using nanotechnologies themselves • Individual questions – write down one thing that they didn't understand, would like to know more about, a question they would like to ask or point they would like to make • Appoint spokesperson |
| 11.00-11.20 DG13 | <ul style="list-style-type: none"> • In plenary: Q&A • Spokespeople to read out questions / experts to answer (if possible) • If time: how does this change/confirm initial views? • Anything that is still unclear? • Anything else they would like to know/any other ways in which they are wondering whether nanotechnologies could be applied? |
| 11.20-11.30 | Break |
| 11.30-11.45 DG14 | <ul style="list-style-type: none"> • Form 3-4 small groups to work through this session • Moderator to explain that we will now be looking at the issue of nanotechnologies in personal healthcare, which includes cosmetics. Based on the evidence they have heard so far: • In what ways might nanotechnologies be useful in this area (Each small group records on sheets) • Can they think of anything they have heard which might be a benefit of using nanotechnologies in this area (Each small group records on sheets) • And can they think of anything they have heard might raise issues about using nanotechnologies in this area (Each small group records on sheets) <p>Each group feeds back one possible benefit and one possible issue</p> |
| 11.45-11.55 | <p>Cosmetics and personal healthcare: Give out handout on nanotechnologies and personal healthcare/cosmetics Moderator reads through handout with group</p> |
| 11.55-12.25 DG15 | <ul style="list-style-type: none"> • Split into 2 breakout groups • Group moderator to recap on main points of handout Check comprehension • Initial reactions • What strikes them most about the information • What stands out • Record positive/negative reactions • Any questions or areas that lack clarity • What more would they like to know • Did any of what they heard change their views • What are their feelings on using personal healthcare products utilising nanotechnologies (why/why not) • What are their feelings on using cosmetics utilising nanotechnologies (why/why not) |

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| | <p>Any differences between types of healthcare/cosmetic products (e.g. would they view certain types of products/products used or applied in certain ways differently)</p> <ul style="list-style-type: none"> • And how does this compare to their feelings on utilising nanotechnologies in medicine (why/why not different) • Individual questions: each to write down something they didn't understand, would like to know more about, a question they would like to ask or point they would like to make • Appoint spokesperson |
| 12.25-12.40 DG16 | <ul style="list-style-type: none"> • In plenary: Q&A (Clive Roberts to take all questions possible; others to be emailed/telephoned through to industry expert) • Spokespeople to read out questions/ experts to answer (if possible) • If time: how does this change/confirm initial views? • Anything that is still unclear? • Anything else they would like to know/any other ways in which they are wondering whether nanotechnologies could be applied |
| 12.40-1.00 | In breakout groups: Participants update their summary |
| 1.00-2.00 | Lunch |
| Afternoon session: Nanotechnologies, food and consumer products | |
| 2.00-2.15 DG17 | <ul style="list-style-type: none"> • Form 3-4 small groups to work through this session • Moderator to explain that we will now be looking at the issue of nanotechnologies in food and food products. Based on the evidence they have heard so far: • in what ways might nanotechnologies be useful in this area (Each small group records on sheets) • Can they think of anything they have heard which might be a benefit of using nanotechnologies in this area (Each small group records on sheets) • And can they think of anything they have heard which might raise issues about using nanotechnologies in this area (Each small group records on sheets) <p>Each group feeds back one possible benefit and one possible issue?</p> |
| 2.15-2.25 | Food applications presentation (Vic Morris) |
| 2.25-2.55 DG18 | <ul style="list-style-type: none"> • Split into 2 breakout groups • Initial reactions • What stood out • Record positive/negative reactions • Any questions or areas that lack clarity • What more would they like to know • Did any of what they heard change their views |

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| | <ul style="list-style-type: none"> • What are their feelings on buying foods utilising nanotechnologies (why/why not) Any differences between types of food • And how does this compare to their feelings on utilising nanotechnologies in the other areas we have discussed (why/why not different) • Group to come up with 3 top questions: something they didn't understand, would like to know more about, a question they would like to ask or point they would like to make • Appoint spokesperson |
| 2.55-3.10 DG19 | <ul style="list-style-type: none"> • In plenary: Q&A • Spokespeople to read out questions/statements / experts to answer (if possible) • If time: how does this change/confirm initial views? • Anything that is still unclear? • Anything else they would like to know/any other ways in which they are wondering whether nanotechnologies could be applied |
| 3.10-3.25 | Break |
| 3.25-3.40 DG20 | <ul style="list-style-type: none"> • Form 3-4 small groups to work through this session • Moderator to explain that we will now be looking at the issue of nanotechnologies in consumer products (by which we mean any product they might buy or use as a consumer, that hasn't specifically been mentioned in the other sessions). Based on the evidence they have heard so far: • In what ways might nanotechnologies be useful in this area (Each small group records on sheets) • Can they think of anything they have heard which might be a benefit of using nanotechnologies in this area (Each small group records on sheets) • And can they think of anything they have heard which might raise issues about using nanotechnologies in this area (Each small group records on sheets) <p>Each group feeds back one possible benefit and one possible issue</p> |
| 3.40-3.50 | Consumer products applications presentation (Jeremy Baumberg) |
| 3.50-4.20 DG21 | <ul style="list-style-type: none"> • Split into 2 breakout groups • Initial reactions • What stood out • Record positive/negative reactions • Any questions or areas that lack clarity • What more would they like to know • What are their feelings on buying consumer products utilising nanotechnologies (why/why not) <p>Any differences between types of consumer products Record types of product where they are more accepting/less accepting of nanotechnologies</p> |

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| | <ul style="list-style-type: none"> • And how does this compare to their feelings on utilising nanotechnologies in the other areas we have discussed (why/why not different) • Group to come up with 3 top questions: something they didn't understand, would like to know more about, a question they would like to ask or point they would like to make • Appoint spokesperson |
| 4.20-4.30 DG22 | <ul style="list-style-type: none"> • In plenary: Q&A • Spokespeople to read out questions/statements / experts to answer (if possible) • If time: how does this change/confirm initial views? • Anything that is still unclear? • Anything else they would like to know/any other ways in which they are wondering whether nanotechnologies could be applied |
| 4.30-4.50 | <p>In breakout groups: Participants update summary</p> <ul style="list-style-type: none"> • Individual exercise: based on the basic information they have so far, on a scale of 1-10: How interested in the concept of nanotechnologies are they personally How much opportunity do they personally see in nanotechnologies How cautious do they personally feel about nanotechnologies How much impact do they see nanotechnologies as having on consumers in general? |

Saturday 1st December

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| Morning session: Controls | |
| 9.45-10.00 | Participants present yesterday's summary (1 from each breakout group) |
| 10.00-10.30 DG23 | <p>In plenary</p> <ul style="list-style-type: none"> – In light of everything you now know, what information do you think should be provided to consumers about products developed using nanotechnologies <ul style="list-style-type: none"> ◦ Whether they would want to know if a product had been produced using nanotechnologies • Format this information should be provided in |
| 10.30-11.00 DG24 | <ul style="list-style-type: none"> • Form 3-4 small groups to work through this session • Moderator to explain that we will now be looking at the issue of controls on nanotechnologies. Based on the evidence they have heard so far: • What assumptions do they have about current controls on nanotechnologies? • Feedback: each group to feed back findings |
| 11.00-11.10 | Break |
| 11.10-11.30 | Presentations on current controls (Qasim Chaudhry) |

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| <p>11.30-12.30 DG25</p> | <ul style="list-style-type: none"> ● Form 2 breakout groups ● (10 mins) Reactions to the presentation ● (5 mins) How does it relate to any previous assumptions they had ● How adequate do they think the current controls are? ● Any views on how the current controls relate to the different applications we have covered <p style="text-align: center;">Probe on</p> <p style="text-align: center;">Medical/personal healthcare/cosmetics applications Food applications Consumer products applications</p> <ul style="list-style-type: none"> ● Any concerns they have ● <i>Individual exercise</i> One thing they would like to know/point they would like to make |
| <p>12.30-1.00 DG26</p> | <ul style="list-style-type: none"> ● Individual Q&A (20 mins) / Expert to answer questions (if possible) ● <i>After Q&A (10 mins)</i> ● How far have their initial views changed/been confirmed by this: thoughts after Q&A ● And any ways in which they might like the controls to be changed |
| <p>1.00-1.10</p> | <p>In breakout groups: Participants update summary</p> |
| <p>1.10-2.10</p> | <p>Lunch</p> |
| <p>Afternoon session: <i>Summing up process</i></p> | |
| <p>2.10-3.10 DG27</p> | <ul style="list-style-type: none"> ● 2-3 groups within the plenary setting; participants to receive printed copies of the cumulative summaries ● Participants to weigh up all the evidence the panel has received and sum up their views on: <ul style="list-style-type: none"> – Nanotechnologies issues and implications: <ul style="list-style-type: none"> ○ Raise the questions/statements/issues they came up with from their summary ○ What do they think are the main opportunities, issues and uncertainties? ○ How do they view nanotechnologies for the different applications – same issues/benefits for all? Different? Why? ○ Are there any developments that are seen as unacceptable for consumers or society as a whole? ○ How did their views change over the course of the Panel? (more positive/negative etc) |
| <p>3.10-3.40 DG28</p> | <ul style="list-style-type: none"> – Controls: <ul style="list-style-type: none"> ○ What kinds of controls do they think should be in place? ○ Raise the questions/statements/issues they came up with from their summary: ○ Who should be involved in controlling nanotechnologies? ○ Any further reassurances they feel they need ○ How did their views change over the course of the Panel? (more positive/negative etc.) |
| <p>3.40-4.00</p> | <p>Break</p> |

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| 4.00-4.20 DG29 | – Any overarching questions they feel remain to be answered |
| 4.20-4.45 DG30 | – From their point of view as consumers: Going forwards, what do they see as the priority areas of importance to consumers as nanotechnologies are developed? <i>Record</i> |
| 4.45 | • Close from individual moderators |
| 4.45-4.50 | • Close from Which? (Sue Davies) |
| 4.50-4.55 | • Close from Opinion Leader (Monique Rotik) |
| 4.55-5.00 | • Thanks and admin (names/addresses, incentives) |