



THE ROYAL  
SOCIETY

# Pharmacogenetics dialogue

Findings from public workshops  
on personalised medicines  
held by the Royal Society's  
Science in Society programme



excellence in science

# 1 Introduction

- 1.1 In September 2004 the Royal Society launched a study into personalised medicines: the hopes and realities of pharmacogenetics. The study was conducted by a working group convened to provide a balanced assessment of the potential of pharmacogenetic technology, by exploring a range of work from fundamental developments in genetics to clinical applications. As part of its terms of reference, the working group was asked to consider whether there were ethical, social, legal and regulatory issues associated with the development of the technology that had not been covered by recent major reports.
- 1.2 In addressing this issue, whereas the ethical issues concerning pharmacogenetics are well described through studies such as the Nuffield Council on Bioethics report of 2002<sup>1</sup>, broader public debate on the subject of personalised medicines is less well advanced.
- 1.3 The Science in Society secretariat at the Royal Society organised three workshops that engaged



The Royal Society working group was asked to consider whether there were ethical, social, legal and regulatory issues associated with the development of pharmacogenetic technology.

76 members of the public in a discussion with specialists on potential developments in pharmacogenetic testing – described for the purposes of the workshops as the genetic basis for both response and adverse reactions to drugs. The workshops were held in London, Manchester and Oxford during February and March 2005 and were stratified by ethnicity, socio-economic status and age respectively.

- 1.4 This report highlights the methodology and key findings from the public dialogue. The findings have subsequently been taken into account in the Royal Society study on pharmacogenetics<sup>2</sup>.
- 1.5 The views contained in this report are those of the public participants. Whilst it is not a report of the views of the Royal Society, the Council of the Society has recognised the dialogue as a valuable contribution to the pharmacogenetics study.

## 2 Aims

### 2.1 The public dialogue had the following aims:

- Explore the healthcare context of pharmacogenetics
- Explore public framings of genetics, genetic tests and genetic information
- Explore the social implications of individual choices about pharmacogenetic testing
- Examine three case studies describing pharmacogenetics on drug safety, clinical trials and the molecular understanding of disease
- Explore ethical issues such as equity, confidentiality and control of pharmacogenetic testing
- Provide opportunities for members of the public to learn about advances in the field of pharmacogenetics

- Provide opportunities for scientists and ethicists or social scientists to learn about public views
- Provide a faithful account and analysis of discussions for use by the Royal Society pharmacogenetics working group
- Compare findings with other studies in the field, notably the Nuffield Council on Bioethics report *Pharmacogenetics: ethical issues* (2003); the Wellcome Trust and Medical Research Council report *Public perceptions of the collection of human biological samples* (2000), and emerging work from the researchers at the Centre for Economic and Social Aspects of Genomics (CESAGen) that explores pharmacogenetic issues with communities in Manchester<sup>3</sup>.

1 Nuffield Council on Bioethics (2002). *Pharmacogenetics: ethical issues*. Nuffield Council on Bioethics: London.

2 Royal Society (2005). *Personalised medicines: hopes and realities*. Royal Society: London.

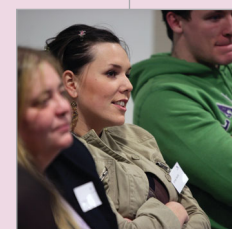
3 The study by researchers at CESAGen on pharmacogenetics has highlighted different issues emerging for public groups (Pieri, E, personal communication). A summary of this project is provided in Appendix 1.

### 3 Methodology

- 3.1 Three public workshops were held in London, Manchester and Oxford during February and March 2005. For each workshop, approximately 24 members of the public were recruited with particular socio-economic characteristics (see Appendix 2). Participants were also recruited to have a range of different attitudes towards science and technology, through completion of a screening questionnaire. The recruitment was undertaken by a market research agency.
- 3.2 The London workshop was stratified by ethnicity (Black and Asian), to explore different cultural issues forged by the technology. The Manchester workshop was stratified by socio-economic status (ABC1/C2DE) as a key variable in determining attitudes towards science and technology. The Oxford workshop was

stratified by age (participants aged over 55 years), because of potentially different attitudes and behaviours of this community to medicines. Each workshop had a scientist and a social scientist or ethicist in attendance to act as a resource for the group discussion. A member of the working group was present at each of the workshops (see Appendix 3).

- 3.3 In each workshop, the public participants were split into two groups of equal size. A facilitator with experience in moderating public discussions on science and technology led each group through a series of questions related to the context and application of pharmacogenetic research (see Appendix 4). The term 'personalised medicines' was used in preference for pharmacogenetics (the caveats of this term were noted). The workshop format is shown in Table 1.



**76 people took part in three workshops.**

**Table 1**

10 minutes	Welcome, introduction	Background to the project and the Royal Society; aims and format of workshop; how they information will be used
50 minutes	First break out session	Introductions; general discussion on how they gain information on health issues; views on medicine, drug effectiveness, bad reactions to drugs; views on genetics, conditions under which people would like to know about possible future disease; views on genetic predisposition; views on genetic tests in relation to other medical tests
15 minutes	Tea break	
55 minutes	Second break out session	Review of scenarios on pharmacogenetics on applications for: drug safety; clinical trials; and the molecular understanding of disease. Explore significance for individuals, society.
20 minutes	Plenary	Feedback and next steps

- 3.4 The sessions were audio recorded and transcribed. Findings from the workshops were summarised into the following nine themes: health advice and trust; drug effectiveness and genetic makeup; genetic tests; genetic exceptionalism; patient sovereignty and the role of the professional; delivery, capacity and control; the limits to patient choice; ethnicity; costs and orphan medicines.
- 3.5 It should be noted that the main focus for the workshops was to explore whether there were

specific public issues related to pharmacogenetic testing as opposed to genetic testing in general. While broader issues, such as consent and the collection and storage of tissue for genetic tests, were discussed, detailed consideration of such themes was not explored as other recent studies have covered them in depth (see Royal Society report on pharmacogenetics, section 5.1 for an overview). This broader governance context should be borne in mind when considering findings from this dialogue.

## 4 Findings from general discussion

### 4.1 Health advice and trust

4.1.1 Most participants in the workshops trusted healthcare professionals, particularly doctors, as their main source of medical advice. This view was particularly strong in the Oxford workshop comprising participants over 55 years. It was weakest in the London workshop, comprising Black and Asian groups.

4.1.2 Across all of the workshop groups, approximately half of the participants supplemented professional advice with their own research on an issue. The Internet (particularly medical and charity sites), medical books, and friends and family were the most cited sources of other information. In the main, this research was predominantly used to help individuals diagnose conditions and research prescribed drugs. Other participants were cautious of the risks in self diagnosis: *'a little knowledge can be a dangerous thing'*.

4.1.3 In the London workshop, which specifically explored the views of Black and Asian groups, a small but significant number (approximately a quarter of the group) were very sceptical of prescribed medication and would often undertake their own research to find alternative treatments, particularly complementary medicines<sup>4</sup>. In this context, professionals were mainly to assist in diagnosis:

*'I usually go [to a GP] to get information on what is wrong with me. Lots of times I don't even use the prescription. If there is a more natural way of dealing with it I'd opt for that'*  
(Female, 35–54, Afro-Caribbean, ABC1, London).

*'When I read up the books [about a prescribed drug] it is not so much what it is for really as the side effects. And you think, it might make me worse, you might get something. But if it sounds quite safe then yes [I would take it] but other than that no'*

(Female, 18–34, Afro-Caribbean, ABC1, London).

4.1.4 However, most participants believed that if they had a serious disease they would seek the

advice of doctors and rely on conventional healthcare treatment. Clinical applications of pharmacogenetic research were thus considered across all groups, rather than being ruled out in principle because of concerns about conventional medicine.

4.1.5 Trust between doctor and patient was complex. Expertise was very important for trust: for instance doctors were preferred over pharmacists for anything other than minor medical advice for this reason. However, all groups recognised that *'professionals are not always right'* and were not expecting to be accurately diagnosed or cured 100% of the time. Rather, trust was fundamentally related to the responsiveness of professionals to individual concerns, rather than specific negative experiences of clinical judgement (misdiagnosis or an adverse reaction to a drug for instance).

*'I think I'm a bit negative there because when my daughter was poorly, the doctor said to me, "You are just an over-reactive parent. You're being very silly. Stick to the medication and in 12 hours she'll be coming round." But 12 hours later she was in a seizure. So it was like, who do you trust? ... I do trust doctors, don't get me wrong ... I just think doctors need to be a bit more sympathetic where children are concerned. I mean they don't have a lot of research on meningitis. They're not that powerful where they can say, "Oh yeah, you've got meningitis." A parent has got to look for it. So the first signs has got to be from the parent, so for a doctor to tell you that you are over reacting then it's like, hang on a minute, I'm not over reacting here there's something wrong. So it was like a conflict then between the person and the doctor, which it was with me. But I have got over that because I got my daughter back. If I hadn't got my daughter back I'd be very angry'*  
(Female, 35–54, White, C2DE, Manchester).

4.1.6 Finally, it should be noted that drug companies were not trusted to give impartial advice on drugs. Newspapers and magazines were also not well trusted as effective sources of advice on healthcare.



Trust between doctor and patient was complex, and was related to the responsiveness of professionals to individual concerns.

<sup>4</sup> One to two participants in the Manchester and Oxford workshops used complementary medicine.

## 4.2 Drug effectiveness and genetic make up

4.2.1 In general, drug and medical development was viewed as fundamentally beneficial and as having transformed society over the past century. However, there were concerns that drugs were currently dispensed far too easily in society, and social and institutional norms facilitated this process as a *'quick fix for the patient, a quick fix for the GP and a quick fix for the pharmaceutical company'* (Male, 55+, White, C2DE, Oxford). The tension between systems for efficient treatment and the impact on the needs of an individual was highlighted in terms of prescription drugs.

*'When you go to a doctor, you're one of 10,000 in a group practice. And those doctors have agreed what drugs they like – you know – from what is available, so they give it to you and you are a group person. So that man with asthma and that man with diabetes – we are just a group, we are not individuals, were only a group of people who need penicillin or hypertension drugs. And like with me. He didn't give me more than ten minutes – my doctor – I hadn't seen him for three years and he just said – asthma – here's your prescription, go see the nurse. He did not want to say, well do you do this, or do you do that, or lets try this'*

(Female, White, 55+, C2DE, Oxford).

4.2.2 However, this mechanistic view of GPs and the role of the patient as a passive recipient of drugs was challenged by several people:

*'Doctors are quite amenable to a lot of feedback. There is no point in taking the drugs and not saying anything, you have got to go back and say what's wrong, what it's causing and get it sorted out'*

(Male, 55+, White, C2DE, Oxford).

4.2.3 The focus on conventional medicine on treating symptoms rather than cause was criticised by several participants.

4.2.4 With regard to drug effectiveness, people's predominant view was that it was related to an individual's [genetic] make up. It was the main

reason people cited for null or side effects to medicines, as opposed to misdiagnosis and poor patient compliance.

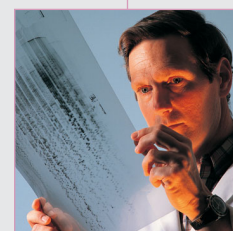
4.2.5 A substantial number of each group (typically around a half) had experienced a bad reaction to a medicine in the past, including antibiotics, analgesics, antimalarials, hydrocortisone and antidepressants. As mentioned, only in a few cases did such experience have a major impact on trust in conventional healthcare. It should be noted that the discussions were not limited to side effects: positive responses were made about a range of treatments. However, discussion of adverse drug reactions was useful for enabling the groups to think about potential pharmacogenetic applications.

4.2.6 The groups had a fairly good understanding of current drug effectiveness, with some knowledge that different classes of drugs, such as those for cancer treatments, were less effective.

## 4.3 Genetic tests

4.3.1 The use of genetic tests to understand predisposition to diseases was explored<sup>5</sup>. People were generally familiar with and understood the concept of this type of genetic test. The most cited examples used by the groups included sickle cell anaemia and cancer tests. The conditions under which people would like to have genetic tests for hereditary diseases were explored. For many participants, genetic tests were seen to be empowering, particularly if lifestyle changes or changes to drug treatments could be made that would improve likely prognosis. For a smaller number of participants (two or three in each group), the fear and distress test caused by test results was a major concern. This latter view was marginally more predominant in the London workshop with Black and Asian groups.

4.3.2 Where changes in lifestyle were not likely to improve prognosis, around half of participants still preferred to have a test if there was a strong likelihood of them having a serious hereditary disease, particularly when considering whether or not to raise a family.



Participants were in the main supportive of pharmacogenetic tests in providing information to make choices about diseases affecting them and treatments available.

<sup>5</sup> Genetic tests were discussed in some depth at the 2003 Royal Society Science in Society programme's public dialogue on genetics and health. For a full report see <http://www.royalsoc.ac.uk/geneticstesting>



*'I think if you knew that something was running in your family, and you have got perhaps several members in your family perhaps died of that illness, you'd like to know whether you were susceptible, so that you could be monitored'*  
(Female, 55+, White, C2DE, Oxford).

*'I suppose something like Huntington's disease where it tends to – you know – you don't find out you have passed it on until the next generation – that might be quite useful. You know, you might desperately want children, but do you want to bring a child into the world that has Huntington's'*  
(Female, 55+, White, ABC1, Oxford).

4.3.3 A significant number of participants (around a third) were unsure what they would do in such circumstances. The complex issues raised by genetic testing, particularly for family members, were highlighted. The latter quote below in particular indicates the difficulties for clinicians in conveying negative genetic test information.

*'If it was me I think I'd have to look into the feelings of my family and I'd have to work with somebody to get my head round it, not on my own.... sitting with a friend, father or anyone that you think that you can actually sit and talk to and somebody gives you a bit of time away from the children or whatever, you can open up a lot more. You can get down to the nitty gritty and know in your own heart whether you want it or you don't'*  
(Female, 35-54, White, C2DE, Manchester).

*'If I went to the doctor about my son, and he said to me, "We've got this drug here but because of his DNA it won't be effective", I wouldn't want to know that. I would rather he would say there isn't a drug yet available that would help him. Because it would be difficult to live with'*  
(Female, 35-54, Asian, ABC1, Manchester).

4.3.4 In all groups, there was discussion of the broader social implications of genetic testing. For some, a distinction was seen between pharmacogenetic testing and routine genetic screening. There was a significant minority who had reservations about the growing use of genetic tests in society.

*'I mean it's always been informed choice ... I suppose the worry about compulsory testing would be the idea that we were acting like Nazi Germany or something ... you must have this test. But it wouldn't be like that. It's only if you've got the disease and you want that drug. It's not a compulsory test'*  
(Male, 18-34, White, C2DE, Manchester).

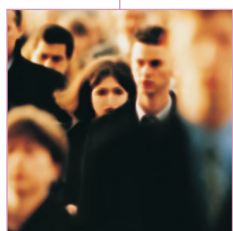
*'Where does it [genetic testing] stop? People consent to it and the next thing you know they push back the barriers a bit more and they push it back and they push it back and before you know it is a foregone conclusion everybody has a little blood test the moment they are born and their genetics are there for life'*  
(Female, 18-34, Afro-Caribbean, ABC1, London).

4.3.5 Discussion examined the predictive accuracy of genetic tests for diseases, for instance monogenetic disorders such as Huntington's disease versus conditions such as bowel cancer where lifestyle factors are important. There was good awareness of the scope and limitations of genetic tests in this context. The use of pharmacogenetic tests was also explored. Whereas only a minority had heard of this application (typically one person per group), participants were able to easily understand the basic principles of such testing and its distinction from other genetic tests<sup>6</sup>.

#### 4.4 Genetic exceptionalism

4.4.1 Participants were asked whether or not they thought genetic tests were distinct from other medical tests. A minority of participants expressed the view that genetic tests provided very highly predictive or diagnostic health information in relation to other tests. Some thought that the very personal nature of the test and the relevance of information to other family members meant there were some differences. In general, upon reflection, the majority of participants felt that there was no fundamental reason for genetic exceptionalism other than the issue that genetic testing is a relatively uncommon technology and *'people can be afraid of the new'*. This finding supports the view of the Nuffield Council study on pharmacogenetics about genetic exceptionalism.

<sup>6</sup> The issue of multiple gene interactions in relation to drug metabolism was not discussed.



A significant minority of participants were concerned about how they would deal with genetic information and the increasing use of genetic tests in society.

## 5 Findings from case studies

5.1 Three case studies were discussed that examined various applications of pharmacogenetic testing for drug safety, clinical trials and the molecular understanding of disease (see Appendix 4). The following issues emerged.

### 5.2 Patient sovereignty and role of professionals

5.2.1 The key theme to emerge across all groups concerning pharmacogenetic testing was the importance of patient sovereignty and the role of the professional to offer impartial advice to enable people to make informed choices. Hypothetically, if test results were unfavourable, participants were supportive of the right of an individual to have access to drugs if they decided that on balance they were willing to accept the risks of a course of treatment and the potential benefits outweighed the risks. This was particularly if there were few treatment options available and the increased risks were seen as marginal. In this context, it should be noted that participants did not view pharmacogenetic tests as providing highly predictive healthcare facts, but rather information on the potential likelihood of positive, null or adverse reactions to particular types of drug.

5.2.2 In making choices about drug treatments, the severity and time taken for side effects to manifest themselves versus general improvement in quality of life was key, as well as the overall likelihood of an adverse reaction. For medical negligence liability, the need for some form of disclaimer or waiver was discussed in some of the groups. Only a few participants thought that, all things being equal, the decision should be left to the professional as to whether a drug should be offered.

*'If I was a patient, my initial reaction would be – well, I want the information about me personally. And based on that information, I will then make a decision in conjunction with my physician. But I don't think – I wouldn't want to leave it to the physician to decide whether I should take the chance or not. Because my heart disease might be such that I'll take any chance to cure it. Even a 35 per cent chance'*

(Male, 55+, White, ABC1, Oxford).

### 5.3 Delivery, capacity and control

5.3.1 Although on balance pharmacogenetic tests were believed to provide useful information for participants in the treatment of diseases, there were serious concerns as to whether the accompanying institutional arrangements could successfully deliver the technology. This ranged from issues of consent and confidentiality in the handling of biological samples; data security; how information was shared with third parties such as insurers (a relatively significant factor); the transparency of relationships between public and private organisations involved in delivery, handling or potential use of genetic information; to pragmatic questions of whether GPs would be sufficiently up to date with the new technology to support the effective use of tests in surgeries, together with their capacity to advise upon and support patient choice.

*'You can't trust hospitals to get it right. This happened to my dad fairly recently. He had a blood test just before an operation. There was another chap there who was Asian. And the next day, it was like he got my dad's results and my dad got his. And just before the operation, the doctor said something and my dad said "no I am a diabetic". And he realised they had mixed it up. So something as big scale as this - how can you trust them to do it right?'*

(Female, 35–54, Asian, ABC1, Manchester).



Participants were against the idea of 'over the counter' access to pharmacogenetics tests.

*'I work in IT and anyone who turns around and says data is safe is talking rubbish'*

(Male, 35–54, White, ABC1, Manchester).

*'It [the potential use of genetics information for insurance] is going to put people off being tested even more. I remember when the whole thing about mortgages and ... whether or not you had an HIV test first came out. And people weren't getting insurance because they said they'd actually gone for a test regardless of whether or not that test came back negative or positive. So it is just going to discriminate against people that might want to have the test for peace of mind'*

(Male, 35–54, Black African, C2DE, London).

*'Now my GP is quite a young GP who I know on occasion has said "I remember when I was a student, I heard all about this". Now, how are we going to keep all these medical practitioners up to date on this as well? How are they going to have the time in their consulting clinics to go through all this?... Everything is becoming increasingly specialised.... No GP could possibly keep up with all the nuances'*

(Female, 55+, White, ABC1, Oxford).

The role of genetic specialists and counsellors was explored in two workshop groups as a means of supporting GPs; however, concerns were expressed by some as to the costs (relative to the benefits) of such support.

5.3.2 The relationship between GPs and pharmaceutical companies was highlighted. There were concerns that *'GPs are under pressure probably from drug companies to prescribe particular types of drugs and are under pressure generally with the amount of people that they probably have to see in any given day'* (Male, 18–34, Asian, ABC1, London).

In the Manchester and Oxford workshops, participants suggested that developments in pharmacogenetics may heighten such tensions as potentially different tests would be available

for different pharmaceutical companies' products to treat a particular condition. Concerns were raised over how this would be practically dealt with and how direct links between doctors and companies impact on trust.

## 5.4 Limits to patient choice

5.4.1 The NHS was seen as the most appropriate institution to control access to pharmacogenetic testing. Despite the strong consensus on patient sovereignty, participants were against the idea of 'over the counter' access to pharmacogenetics tests in chemists or the Internet because of the need for trusted expert advice to support patient choice in the use of such tests (the problems in effectively regulating the Internet were noted).

*'You could create enormous concerns without adequate follow-up. And you do need the advice from the counsellor, and you do need to be able to go to a competent physician who can tell you what sort of treatment you ought to have, and what the types of possibilities are for dealing with it. So, I personally am totally against over the counter and by-mail genetic tests, because they just don't come with the proper back-up'*

(Male, 55+, White, ABC1, Oxford).

5.4.2 On the issue of whether patients should have the right to ask for a particular drug treatment without taking the associated pharmacogenetic test, on the whole participants were not supportive of this position if there was a likelihood of an adverse reaction, irrespective of an individual's reason for not taking the test (including, for instance, issues of confidentiality and who may gain access to the information). This was mainly because patient choices were no longer informed by appropriate medical evidence. It was recognised that people could effectively be excluded from a treatment if they were not willing to have a pharmacogenetic test accompanying a medicine.



**Patients should not have the right to ask for a particular drug treatment without taking the associated pharmacogenetic test.**



## 5.5 Ethnicity

5.5.1 The issue of genetic tests and race were explored, and the potential of racial stratification in relation to drug metabolism. In general, people thought that genetic variants that affect disease or metabolism were likely to be more common in some ethnic groups than in others. However, they also recognised variation between and within ethnic groups. Although participants were wary of race being used as a proxy for genotype, overall they were fairly pragmatic on the issue of disease prevalence within communities:

*'Either it is or it isn't. You either get a higher proportion of diabetes from a certain class of people or you don't. It is not really stigmatisation'*

(Male, 35–54, White, C2DE, Manchester).

*'They do that with diabetes don't they? They say that Asians suffer more from diabetes than other groups. I think that with medicine you accept that there are differences'*

(Female, 35–54, Asian, ABC1, Manchester).

5.5.2 For the workshop with Black and Asian groups, in general, the use of genetic tests to provide medical information to help manage disease was welcomed. For instance, discussion at the London workshop highlighted how greater awareness of sickle cell anaemia had helped Afro-Caribbean communities to better prepare and provide support for people with the disease.

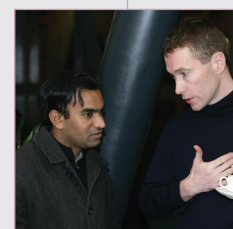
## 5.6 Cost and orphan medicines

5.6.1 Initial discussion on this issue centred on the principle that all members of society should be afforded equitable provision for health by the state, irrespective of the cost implications of this.

*'Its ethical isn't it. Just because I may be unresponsive [to a drug], doesn't give me any less right to have an effective treatment. It's the same illness. Just because my body is predisposed that way, does not mean I should have less of a choice. I should have the same choice as everyone else. And just because I am commercially non-viable as a sick individual, doesn't make it right'*

(Female, 35–54, White, C2DE, Manchester).

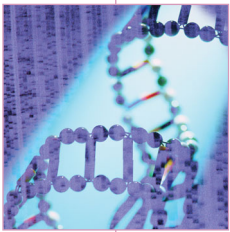
5.6.2 In general, participants thought it was unrealistic to expect the costs for orphan medicines to be subsidised by pharmaceutical companies' profits, rather than being met by the state or charities. The enormous costs of drug development were discussed, and the potential focus on diseases of developed countries. After discussion, while recognising the principle of providing members of society a level of healthcare, a range of views were expressed about the extent to which financial support should be given by the state to provide research into groups with relatively rare, unresponsive, pharmacogenetic variants.



**In general, the use of genetic tests to provide medical information to help manage disease within particular ethnic communities was supported.**

## 6 Conclusions

- 6.1 In general, participants trusted conventional healthcare professionals to provide advice about serious medical conditions and to mediate the information provided by genetic tests. Trust was fundamentally related to the responsiveness of professionals to individuals' concerns.
- 6.2 Participants had good awareness of genetic science and the complex issues forged by genetic tests for both the individual and society. Pharmacogenetic tests were not viewed as providing highly predictive healthcare information, but rather illustrated potential likelihoods of good, null or adverse reactions to particular types of drugs.
- 6.3 A significant minority of participants were concerned about how they would deal with genetic information and the increasing use of genetic tests in society. However, for most participants, genetic tests were seen to be empowering, particularly if changes to lifestyle or drug treatments could be made to improve disease prognosis.
- 6.4 Participants were generally supportive of pharmacogenetic tests in providing information to make choices about diseases affecting them and treatments available. The importance of patient sovereignty and the role of the professional to offer impartial advice and to enable people to make informed choices was a major issue.
- 6.5 Of greater concern for participants was the practical issue of delivery of pharmacogenetic technologies by institutions. Although the NHS was seen as the most appropriate organisation to control access to such testing, issues were raised about whether appropriate safeguards could be given to ensure the accurate, reliable and confidential use of pharmacogenetic tests. The capacity of GPs to be sufficiently up to date with the technology to support widespread use was questioned.
- 6.6 Participants felt patients should not have the right to ask for a particular drug treatment without taking the associated pharmacogenetic test if there was a likelihood of an adverse reaction, irrespective of an individual's reason for not taking the test. It was believed that by not taking the test a patient would not be fully informed of the risks of a given drug treatment.
- 6.7 Participants were against the idea of 'over-the-counter' access to pharmacogenetics tests in chemists or the Internet, as they were not believed to provide the appropriate professional support to patients to deal with the information.
- 6.8 In general, the use of genetic tests to provide medical information to help manage disease within particular ethnic communities was supported. Groups were wary of using race as a proxy for genotype.
- 6.9 Views were split as to the extent to which financial support should be given to provide research into groups with relatively rare unresponsive genetic types.



The findings have subsequently been taken into account in the Royal Society pharmacogenetics study.

## Appendix 1: Preliminary findings from pharmacogenetic public workshops by researchers at CESAGen

Ongoing research conducted by Professor Brian Wynne and Dr Elisa Pieri at Lancaster University suggests that members of the public are extremely aware of the complexities and various impacts generated by the provision of genetic information, even when they do not have knowledge of the biology. They are deeply sceptical of the uncritical portrayal of health-related genetic information as unconditionally beneficial, and the notion that genetic information ought to be sought for its own sake.

The findings come from a study done at the Economic and Social Research Council (ESRC) Centre for Economic and Social Aspects of Genomics (CESAGen) in collaboration with the North West Genetics Knowledge Park (Nowgen), and involving 'hard-to-reach' sections of the public: the elderly, young people, parents of young children, as well as members of the Chinese, Jewish and Afro-Caribbean communities in the Manchester area.

The study, which runs until May 2006, focuses on the relative weight of genetics against other factors, such as environmental ones, particularly in conditions that are relatively common (i.e. diabetes), and it explores views of projected new genetic health technologies like pharmacogenetics. Its aims are to highlight salient knowledge, recognise neglected questions and understand public meanings and framings, particularly when they differ from the established ones. By considering some of the main implications for public health resource allocation, the research elicits public values and priorities in an attempt to encourage scientific and expert reflections on existing arrangements, practices and assumptions, including projected constructs of 'the public'.

## Appendix 2: Recruitment profile for pharmacogenetics workshops

	Total	Gender		Socio-economic grade		Age		Ethnicity	
London	28	Male	15	ABC1	15	18–34	15	White	0
		Female	13	C2DE	13	35–54	9	Asian	14
						55+	4	Black	14
Manchester	24	Male	12	ABC1	13	18–34	8	White	19
		Female	12	C2DE	11	35–54	10	Asian	4
						55+	6	Black	1
Oxford	24	Male	12	ABC1	13	18–34	0	White	20
		Female	12	C2DE	11	35–54	0	Asian	2
						55+	24	Black	2

## Appendix 3: Specialist participants in the pharmacogenetics workshops

### London:

Dr Hilary Harris, General practitioner, South Manchester\*

Professor Peter Lipton, Head of Department of History and Philosophy of Science, University of Cambridge

Professor Marcus Pembrey, Professor of Paediatric Genetics, Institute of Child Health, University College London

Dr Ilina Singh, Senior Researcher, BIOS Research Centre for the study of Bioscience, Biomedicine, Biotechnology and Society at the London School of Economics and Political Science

### Manchester:

Dr Mairi Levitt, Deputy Director, ESRC Centre for Economic and Social Aspects of Genomics (CESAGen), Lancaster University

Dr Bill Newman, Senior Lecturer, Department of Clinical Genetics, St Mary's Hospital, Manchester

Dr John Stageman, Vice President and Head of Global Sciences and Information, AstraZeneca\*

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### Oxford:

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\* Denotes a member of the Royal Society pharmacogenetics working group

## Appendix 4: Topic guide

### Comments on the topic guide were gratefully received from:

- Professor George Gaskell and colleagues, BIOS Research Centre for the study of Bioscience, Biomedicine, Biotechnology and Society at the London School of Economics
- Dr Elisa Pieri, ESRC Centre for Economic and Social Aspects of Genomics (CESAGen), Lancaster University
- Dr Adam Hedgecoe, Department of Sociology, University of Sussex
- Dr Sophie Taysom and colleagues, Human Genetics Commission
- Dr Sandy Thomas and colleagues, Nuffield Council on Bioethics

### Session 1 Welcome and introduction (10 mins) (Lead Facilitator)

- Welcome and thanks for attending
- Introduce self; about the Royal Society
- Research conducted as part of a study by the Royal Society on personalised medicines
- Aims for the day
  - Explore views on issues such as health, medicines, genetics and genetic testing
  - Look at two case studies to explore potential applications of genetic tests in relation to how individuals respond to medicines
- Process
  - Mixture of whole group and break out sessions
  - The groups will be moderated (introduce other moderator)
  - Support from specialists (introduce scientist and social scientist/ethicist)
- How their views will be used in study
- Not expecting them to be experts – chosen to gain views from members of public – how these are formed and develop as a result of discussion
- Housekeeping
- Questions

## Session 2 First breakout group (50 minutes)

- Introduce self
- Confidentiality
- Permission to record
- Group rules: not to talk over one another/one conversation at a time
- Introduce specialists and their role
- Introductions from group – name, where live, one thing they think of in relation to word science
- Views on healthcare
  - Where they seek advice/get information on health
    - Probe professionals/self/family friends/Internet
- Views on medicines and prescription/over the counter drugs
  - Probe [for example self or professional diagnosis/treatment/usage/concerns/alternative therapies/behaviour (correct dose/finish course)/cost, etc.]
  - How effective do they think drugs are?
  - Has anyone ever had a bad reaction to a medicine?
    - Views on why this might be (wrong dose; misdiagnosis; drug not taken; but also about how different people's bodies respond to drugs)
- What thoughts come to mind when say the word genetics?
  - Probe understanding of uses of genetics
  - Probe people heard of genetic test
- [Describe] Genetic tests enable us to understand the genetic make up of an individual. This helps us to understand an individual's susceptibility to certain diseases and how their body may react to treatments for disease. Does not mean they will succumb to disease, or will not react to a treatment; rather likelihood of this. Environmental and lifestyle factors important also (for instance, in bowel cancer, less than 1 in 10 cases due to gene defects – mainly diet and lifestyle). [Clarify experts]
  - Under which conditions would people like to know about possible future disease? [N.B. that they are genetically predisposed to a disorder?] ([Probe only if cure available/ support from state; family, etc.]
  - What does it means personally to be said to be genetically predisposed to a particular condition? [impact on health behaviour; family; stigmatise]
  - Do you think that that the information provided through a genetic test is different from information gained through other medical tests? [for instance a pregnancy test/cholesterol test/blood sugar, etc.]
- [Describe] As well as disease susceptibility, genetics can provide better understanding of how we are likely to react to certain drugs or medicines – and this may lead to 'personalised medicines'. Does not mean that individual patients will have medicines tailor-made for them. Rather that, on the basis of information about their genetic make-up, one medicine rather than another may be prescribed, or the dosage of a particular medicine changed. [clarify experts]
  - Have they heard of 'personalised medicines' or pharmacogenetics?
  - Gain initial views/ framing – in relation to issues emerging from previous discussion
- Explain the rest of the meeting will explore this aspect of genetic testing in depth and will have a presentation on this in a few moments.
- Hand out case studies – ask to read over coffee. Explain these will be presented.
- Break

## Tea and coffee 15 minutes

## Session 3 Second breakout session (55 minutes)

- Welcome back
- Look at two case studies that illustrate potential applications from the field of personalised medicines.
  - RED GROUP EXPLORES CASE STUDIES 1 AND 2
  - BLUE GROUP EXPLORES CASE STUDIES 1 AND 3
- Explain case study



### Case study 1. Cardion and heart disease (this is a hypothetical example) (RED AND BLUE GROUPS)

A new drug called Cardion has been found to be very effective in treating heart disease in some groups but less so in others. Cardion is broken down (or metabolised) by a chemical produced by the human liver. Some people (particularly those from Chinese communities) are poor metabolisers of Cardion. This means that the medicine is not broken down quickly enough by the liver and builds up in the body, which can have serious consequences. A genetic test is available that indicates that for this group of people the chances of experiencing an adverse reaction to the drug is 65% – in some cases this reaction can lead to serious liver damage. There has been much coverage of Cardion in the press as a new wonder drug. There are other drugs on the market that are less risky but also less effective than Cardion.

N.B. seek points of clarification from scientist or social scientist/ethicist

- General views [how does this feel to them?]
- What do people think the implications of this are for?
  - Individuals – probe
    - Ethnicity
    - Right to demand the drug if they are at risk of an adverse reaction
    - Option to receive treatment without taking an associated test
  - Society – probe
    - Doctor's rights to choose not to prescribe the drug/liabilities
    - Ethnicity and exclusion

### Case study 2. Genetic tests for drug safety (RED GROUP ONLY)

A potential application of the type of genetic test illustrated in the Cardion example is in the area of drug safety. Clinical trials are a process through which drugs are tested before they are licensed to come onto the market. A better understanding of how people metabolise drugs will enable drug companies to better focus the trial on those people who genetically are most likely to respond to a drug. So for instance, by removing poor metabolisers of drugs from the trial study (those people who are not good at breaking down drugs and more likely to experience an adverse reaction), drug safety in the test is increased.

The chemicals produced by the liver involved in metabolism tend to work on classes of drugs, rather than one specific medicine. If you are a poor metaboliser of one type of drug, it is likely you may be a poor at breaking down others (in some cases, drug dose can be altered to compensate for this). Although these advances have many benefits for people who respond well to drugs, it could lead to a situation where it becomes commercially unattractive to create new drugs for small numbers of people with rare 'unresponsive' genetic types.

POINT OUT – not only cause of adverse reactions (not taking prescriptions properly; lifestyle/ environmental factors)

N.B. seek points of clarification from scientist or social scientist/ethicist

- General views [how does this feel to them?]
  - What do people think the implications of this type of approach are for?:
    - Individuals (probe the classification as a poor metaboliser); implications for safety of prescription for those who opt against genetic test
    - Society (probe role of markets/costs/therapeutic orphans: i.e. where a drug is found to be highly effective in a small minority of patients which would not justify the R and D costs)
  - Who should take responsibility for pharmacogenetic testing and where is it most appropriate for this to take place?
    - Probe doctor, pharmacist, over the counter.
    - Probe prescribing, counselling and dispensing.
- [Facilitator note: It is likely that most repeat prescribing will be undertaken by community pharmacists in the future. Pharmacists will shortly have a new contract which seeks to expand their professional role in relation to prescribing, counselling and dispensing.]
- Finally, thinking back to the issues that emerged in the discussions before coffee [restate], is there anything you feel differently about as a result of the case studies?

### Case study 3. Diseases and genetic testing (BLUE GROUP ONLY)

Many of our current disease definitions such as cancer, diabetes, heart disease and asthma may be actually very different diseases at the genetic level. For instance, people with a specific gene may produce one type of asthma; others with another gene produce a different type of asthma – even though the symptoms for these conditions appear the same they are in fact different diseases. Understanding disease at the genetic level could lead to different drug treatments being developed, with patients being separated into different groups according to a classification of how they are likely to respond to drugs. While these advances have many benefits for people who respond well to drugs, it could lead to a situation where small numbers of people are categorized as having rare ‘unresponsive’ genetic types.

Developing this type of technology also means that a genetic test to decide on whether to prescribe a drug may also be a predictive test for the type and severity of disease a patient might develop. The fact that a patient was receiving a particular medicine, or no medicine, could indicate the outlook for their condition. This information could be inferred by anyone with access to an individual’s prescription information, for instance the doctor, the pharmacist or the person at the till, and even insurers.

N.B. seek points of clarification from scientist or social scientist / ethicist

- General views [how does this feel to them?]
- What do people think the implications of this type of approach are for?:
  - Individuals [probe orphans]
  - Society (probe confidentiality).
- Is there any difference from people inferring information from medicines prescribed on basis of a genetic test as opposed to general prescriptions?

Finally, thinking back to the issues that emerged in the discussions before coffee [restate], is there anything you feel differently about as a result of the case studies?

### Session 4 Plenary (20 minutes)

- Feedback from group 1 (moderator)
- Feedback from group 2 (moderator)
- Next steps and feedback
- Thanks and close

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