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Are Scientists Right and Non-Scientists Wrong?

Reflections on Discussions of GM

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ABSTRACT

The aim of this article is to further our understanding of the “GM is unnatural” view, and of the critical response to it. While many people have been reported to hold the view that GM is unnatural, many policy-makers and their advisors have suggested that the view must be ignored or rejected, and that there are scientific reasons for doing so. Three “typical” examples of ways in which the “GM is unnatural” view has been treated by UK policy-makers and their advisors are explored. These are: the Government’s position (DEFRA Report), the account of the Nuffield Council on Bioethics, and the position of Nigel Halford, a scientist with an advisory role to the Government. I show that their accounts fail to mount a convincing critique. Then, I draw on an empirical research project held during 2003-2004 at the University of Newcastle-upon-Tyne in the north east of England. Scientists met with non-scientists in a range of facilitated one-to-one conversations (“exchanges”) on various environmental issues, one of which was on GM. Our findings show that some scientists who rejected the “GM is unnatural” view struggled to do so consistently. Their struggle is interpreted in terms of a conflict between a so-called “scientific” worldview, and a different worldview that underlies the concerns of those who held

the “GM is unnatural” view. This worldview is explored further by an examination of their concerns. What distinguishes this worldview from the “scientific” worldview is that the instrumentalisation of the nonhuman world is questioned to a larger extent. I conclude that, because the underlying concerns of those who held the “GM is unnatural” view were not with GM as such, yet with a worldview which was considered to be problematic, and of which many GM applications were held to be expressions, policy-makers and their advisors should reflect on the critical worldview of those who claim that GM is unnatural if they want to engage seriously with their concerns.

KEY WORDS

biotechnology, deliberative exchange, policy, science, unnatural, worldviews

Are Scientists Right and Non-Scientists Wrong? Reflections on Discussions of GM

INTRODUCTION

Opponents of genetic modification technology (GM) have frequently argued that GM is unnatural. Research suggests that this is a very common view among the public in many countries, including the UK. Those who hold the view also use words like “tampering”, “messaging”, or “muddling” with nature when they express their objections to GM. Their belief is that GM alters nature radically, and that such alterations are problematic. However, the “GM is unnatural” view has been widely criticised. The key objection is that the claim that GM is unnatural must be meaningless as defining what is “natural/unnatural” would not be possible. Cooley and Goreham, for example, write: “Given the difficulty in discovering a plausible definition of ‘unnatural’, if we truly desire to make headway with the moral issue of transgenic organisms, we might have to stop spending time on the ‘unnatural is unethical’ argument and seek better arguments” (2004, p. 54). In the UK, many

policy-makers and their advisors seem especially keen to ignore or dismiss the “GM is unnatural” view. The critics of the “GM is unnatural” view also claim to have “scientists” on their side: “(the) ‘natural/unnatural’ distinction is one of which few practising scientists can make much sense” (Nuffield Council on Bioethics, 1999, p. 15 par. 1.40). This apparent division between scientists’ and non-scientists’ perceptions is usually attributed to the “public’s” - that is: the non-scientists’ - lack of understanding of GM. If they understood the technology better, they wouldn’t oppose it. Evidence from recent studies suggests that this is not true. Concerns about the unnaturalness of GM do not go away as people learn more about the technology. However, criticisms of the “GM is unnatural” view are equally persistent.

The aim of this article is to improve our understanding of the “GM is unnatural” view and the critical objections to it. I draw on the views of a small group of scientists and non-scientists who participated in a recent research project, conducted in Newcastle-upon-Tyne in the north east of England. The project complements other studies in two respects. Firstly, the participants met in facilitated one-to-one meetings (or “exchanges”) involving one academic scientist and one non-scientist recruited from the local community. Each participant took part in a series of these meetings, in which they discussed different environmental issues, including one on GM. If scientists’ and non-scientists’ perceptions of the “GM is unnatural” view are very different, we should see this quite clearly in the exchanges. Secondly, the participating scientists were not GM experts but came from a range of (environment-related) disciplines. If it is correct that “scientists”, and not only those scientists working on GM, do not accept the “natural/unnatural” distinction, we should see this critical view among our scientists. We found that the views expressed by our participants did not reveal this simple division between scientists and non-scientists.

Instead, we found that the positions of both groups (even in our very small project) were more complex and varied. By analysing their views, I hope to provide important insights into both the “GM is unnatural” view and the critical response to it.

In the first section, I present three “typical” examples of ways in which the “GM is unnatural” view has been treated by UK policy-makers and their advisors. In the second section, I introduce our empirical study in further detail. The positions of two scientists who rejected the “GM is unnatural” view are presented as case studies of different perspectives on this view in the third section. The data received provide important clues to why many scientists may hold the view, and how they struggle to maintain it. One scientist, however, strongly endorsed the “GM is unnatural” view. In the fourth section, his views are explored as a rare case study of a scientist who expressed a number of concerns related to the process, the outcome, and the attitudes of those involved with GM. His account is complemented with the views of other scientists and non-scientists who expressed similar concerns. Their accounts are suggestive of an underlying worldview which is generally inconsistent with the development of GM technology. In the fifth section, I note that all of our participants expressed some support for some GM applications, and I reject the suggestion that this is inconsistent with the “GM is unnatural” view. In the sixth section, I explore the wider unease that our participants showed with a range of other technologies and practices, and I interpret this as a sign that concerns about GM reflect a concern with an underlying worldview.

UK POLITICS AND THE “GM IS UNNATURAL” VIEW

A number of UK policy-makers and policy advisors have ignored or rejected the “GM is unnatural” view. I shall briefly discuss three examples of how this has been done. These are: the Government’s account (DEFRA Report), the Nuffield Council on Bioethics’ account, and the position of Nigel Halford, a scientist at Rothamsted Research, UK, who also has an advisory role to the Government.

In the Government’s Report “The GM Dialogue: Government Response”, the Government responds to the findings of the GM dialogue announced by the Secretary of State in 2002 (DEFRA, 2004). The dialogue was sponsored by the UK Government and the devolved administrations and aimed to foster mutual understanding between people with different views on GM, to enlarge public understanding of the issues, and to gather further evidence that could be used by Government to make decisions. The dialogue comprised three main strands: a science review (conducted by a panel of independent scientists chaired by the Government’s Chief Scientific Advisor working with DEFRA’s Chief Scientist), a costs and benefits study (by the Government’s Strategy Unit), and a nation-wide public debate on GM, later referred to as “GM Nation” (managed by an independent steering board).

In its “Response”, the Government evaluates and endorses the Strategy Unit’s conclusion that future developments in GM crops could offer more significant benefits than existing GM crops for UK farmers. The Government suggests that “the responsible development of GM crop technology could offer significant potential benefits in the UK and globally, including to developing countries” (2004, pp. 28-29 par. 5.62 and 5.64). However, the Government does not engage with the GM public debate’s finding that there are people who think that humans should not use GM technology to change nature. Instead, the Report simply quotes from the GM Nation Report by stating that many “people suggest that the human species has no right to

use GM technology to alter the course of nature” (2004, p. 29 par. 5.64; GM Public Debate Steering Board, 2003, p. 21). While the Government comments on other parts of the GM Nation Report, from which it quotes extensively, no comment is made on the “GM is unnatural” view. This suggests that the Government judges that the concerns of those who hold the “GM is unnatural” view do not outweigh the “significant potential benefits” which GM could offer.¹ This interpretation is further supported by the Government’s apparent endorsement of the Nuffield Council on Bioethics’ conclusion that “there is an ethical obligation to explore these potential benefits responsibly, in order to contribute to the reduction of poverty and to improve food security and profitable agriculture in developing countries” (2004, p. 30 par. 5.65 and p. 7 Executive Summary 25). The lack of attention given to the views of those who think GM might constitute an illegitimate interference with the order of nature creates the impression that they are considered to be irrelevant, or that they would vanish once people learned more about the “significant potential benefits”.

While the DEFRA Report does not examine the claims made by those who hold the “GM is unnatural” view, it refers approvingly to the Nuffield Council on Bioethics. The Council, which is an independent organisation, is held in high regard by Government, providing advice on ethical matters. It has published two reports on GM and examines the “GM is unnatural” view in both. In its first Report, the Council claims that the “‘natural/unnatural’ distinction is one of which few practising

¹ In the executive summary of the “Response”, the Government writes: “We recognise that people have legitimate concerns about GM crops. Nevertheless, we believe that the responsible development of GM crop technology could offer significant potential benefits both in the UK and globally” (DEFRA, 2004, p. 7 Executive Summary 25).

scientists can make much sense” (1999, p. 15 par. 1.40). The Council elaborates on its critique in its second Report:

“Conventional plant breeding is often understood as the selection of particular individuals from a great variety of naturally occurring types of plants (and) tends to be seen as natural. However, plant breeders also create plants which would not be achievable by judicious interbreeding, using techniques such as wide-crossing. ... Another technique, mutation breeding, involves the exposure of plants and seeds to radiation and chemical substances. ... Thus, it is important to note that the deliberate alteration of plants as they occur in nature has been practised and accepted for several decades. In this context, genetic modification can be seen as a new means to achieve the same end; it is certainly used in that way. It differs from conventional plant breeding in that it can allow for much faster and more precise ways of producing improved crops. For this reason, we concluded in our 1999 Report that it was not helpful to classify a crop that has been arrived at by means of conventional plant breeding as “natural”, and to classify a crop with the same genetic complement as “unnatural” if it has been produced through genetic modification” (2003, p. 24 par. 3.8).

While the Council’s explicitly stated purpose is to object to the making of any distinction between what is “natural” and what is “unnatural” (and to close the door on those who claim that GM is problematic because of its unnaturalness), the distinction sneaks in through the back door when it distinguishes “plants as they occur in nature” from plants created by “deliberate alteration”. The Council appears to concede that some things might be more natural than others. While the Council may still hold that the view that what is unnatural is unethical is flawed, it implicitly grants that the reason for this may not be related to problems with defining “naturalness/unnaturalness”. In spite of the Council’s claims, what the Council really argues is not that there is no boundary between the natural and the unnatural, but that the introduction of GM science does not mark the point where the boundary between the natural and the unnatural has been crossed. The argument is then that because some other technologies, such as wide crossing and mutation breeding, have been

“practised and accepted for several decades”, GM may not be different from these technologies insofar as the naturalness-unnaturalness issue is concerned, and therefore cannot be rejected on this basis.

Three objections must be raised. Firstly, when the Council writes that “deliberate alteration of plants ... has been practised and accepted”, the impression is created that all other methods of alteration are accepted by everyone, and the possibility is ignored that some people may have objections to some or all methods of alteration. Secondly, the Council’s view is that these methods are acceptable because they are accepted, yet one could object that not all things which are accepted are acceptable. And thirdly, as the argument presupposes that a distinction between “the natural” and “the unnatural” can be made, the Council should acknowledge that a debate can be held about where the boundary should lie, rather than suggest that such a debate would be meaningless.²

A third critic of the “GM is unnatural” view is Nigel Halford, who works at Rothamsted Research, the largest agricultural research centre in the UK. Halford has been involved with the genetic modification of plants, including a field trial on GM wheat. He is a member of the Advisory Committee on Animal Feedingstuffs which provides advice to DEFRA and the devolved administrations on the safety of animal feeds and feeding practices, and a former panel member of CropGen, a pro-GM lobby group. I have chosen to comment on Halford’s position as he has, unlike many other scientists, published his views on GM and presented his arguments at a significant number of public meetings (2003, p. vi). Halford develops his critique in response to Prince Charles, “who has been quoted as saying” that “mixing genetic material from

² The Council claims not only that most scientists would agree that the debate is meaningless, yet also that “the decision about what is unnatural cannot be one for public policy” (1999, p. 17 par. 1.51).

species that cannot breed naturally, takes us into areas that should be left to God” (2003, p. 83). Halford offers three criticisms. Firstly, he argues that “mixing genetic material from sexually incompatible species” has been going on for a long time by means of other techniques which are now “accepted readily” (2003, p. 16, p. 83). Halford refers to triticale as an example, which is the product of forced crossing between wheat and rye, and the production of which necessitated chemical treatment to overcome the problem of wheat and rye chromosomes not pairing (2003, p. 83, p. 15).³ Triticale has been commercialised since 1969. Secondly, he claims that “the species alive today are part of an evolutionary continuum, not separate entities (...). So how can it be fundamentally wrong to move genes between species?” And finally, Halford claims that the important question is not where a gene comes from or how it gets there, but “what it does”. He argues that “a gene producing a poison ... crossed into a crop plant from a wild relative is clearly much more dangerous than a gene producing a benign protein that is introduced into a crop plant by genetic modification” (2003, p. 83).

All of Halford’s arguments are problematic. The problem with his first argument is, as mentioned in the context of discussing the Nuffield Council’s position, that it overlooks the possibility that those who oppose GM because it is unnatural might also have problems with other technologies, such as forced crossing. Halford assumes that these other technologies are “accepted readily” by everyone but does not offer any evidence to support this assumption. Indeed, we might wonder how

³ The Nuffield Council on Bioethics also uses the example of triticale in the context of comparing conventional methods and GM, and in the context of making the argument that “to the plant breeder, genetic modification is simply the latest technology which breeders hope to bring to bear in their quest for ever-improved crops” (1999, p. 21 pars. 2.6 and 2.7.)

many people know about forced crossing and mutation breeding. The reason why not many people have questioned these technologies may simply be that not many people know about them, rather than that they are “accepted readily”. Halford’s second criticism is incomplete. The view that all species are related is a scientific theory. The essence of this theory is that the boundaries between species are fluid, rather than fixed. What it does not establish, however, is the alleged implication that shifting genes between species is acceptable. An argument to explain why the former (scientific) view should lead to the latter (moral) view is lacking. Halford’s final criticism conflates human and nonhuman causation. If a stone falls off a mountain and kills someone, nonhuman causes may be identified which contributed to that person’s death. If, however, the stone fell because someone pushed it, that person is a causal factor in the other person’s death. By analogy, if someone eats a poisonous substance that has been produced by non-preventable interbreeding of a plant with a wild relative, that substance may cause that person’s death. If, however, the substance has been created by humans, they are causally implicated in the death of the person eating it. Since Halford states that “no scientist will ever describe anything as completely safe” (2003, p. 81), the possibility exists that genetic modification might introduce a gene producing something that is not a “benign protein” (2003, p. 83). If this leads to someone’s death, unlike the situation where someone dies from eating a malign protein that was not produced by humans and not known to be malign, humans are causally implicated. There is a clear moral difference between the hypothetical scenarios, which is ignored by Halford. Prince Charles might be right that the question of whether or not genetic change is caused by humans is morally significant. My conclusion is that Halford’s three criticisms fail to challenge Prince Charles’ claim.

What the accounts presented above aim to do is to discredit the view of those who object to GM on the basis of its unnaturalness. All fail to mount a convincing critique. Nevertheless the belief that the “GM is unnatural” view is wrong is widely held. In an international study with “stakeholders” involved with GM (“the PABE study”), for example, data were gathered from interviews with stakeholders, analysis of documents written by them, and attendance of stakeholders’ meetings by researchers (Marris et al., 2001).⁴ It was found that “many promoters of GMOs (GM organisms) and scientists” hold the view that “the public thinks – wrongly – that GMOs are unnatural” and “insist on the idea that there is nothing fundamentally novel about recombinant DNA techniques” (Marris et al., 2001, pp. 83-84). In focus groups with ordinary citizens, the same study found that ordinary citizens frequently expressed the “GM is unnatural” view.⁵ While the same study acknowledges that those stakeholders who are identified as “anti-GMO lobbyists” shared this view, their views are not explored further (Marris et al., 2001, p. 84). Other research has found that the views of these “lobbyists” are usually referred to “in condemnatory terms” by

⁴ The stakeholders came from five countries (France, Germany, Italy, Spain, and the United Kingdom) and were “employees or spokespersons of any institution which plays a role in the creation, regulation, testing, and putting of (correction: on) the market of GMOs (GM organisms)” and anybody who expressed themselves “in public spheres” on GM (Marris et al., 2001, p. 26). A minimum of twenty open-ended in-depth interviews were held in each of the five countries. Participant observation consisted in researchers being present at stakeholder meetings and analysing the discourses used by stakeholders. The documents that were analysed were a number of documents written by stakeholder organisations. The PABE study also involved fifty-five focus groups on the subject with ordinary citizens from the five countries.

⁵ The “GM is unnatural” view was also held by many participants in a 1996-1997 study with nine focus groups involving UK citizens from a range of social groups (Grove-White et al., 1997; and see also Deane-Drummond et al., 2003, pp. 22-23).

those who reject the “GM is unnatural” view (Cook, 2004, p. 42). Scientists would know better and avoid “unnaturalness talk”, which would be emotional, understood in the sense of “irrational” or devoid of cognitive substance. The division of the debate between rational scientists, policy-advisors, and regulators on the one hand, and irrational others on the other hand, is suggested by the Nuffield Council on Bioethics’ claim that “few practising scientists can make much sense” of the “‘natural/unnatural’ distinction” (1999, p. 15 par. 1.40. See also e.g. p. 91 par. 5.38). A similar division is suggested by the other accounts under discussion. When the DEFRA Report talks of “people’s legitimate anxieties” and “legitimate ethical concerns”, these concerns are contrasted with the “significant potential benefits” which “GM crop technology could offer” (2004, p. 5, p. 7 Executive Summary 14, 25). This raises the question of whether the Government really thinks these “anxieties” are “legitimate”. My impression from reading their Report is that the answer to this question is negative, as the suggestion is made that risk assessment by scientists and regulators should convince us that a “ban” is not “the appropriate response” (2004, p. 15, par. 5.6). The possibility that some people may still have anxieties once the risks associated with a particular technology have been assessed to be low by scientists and regulators has been largely ignored (2004, p. 26, par. 5.54). Halford is less optimistic about the possibility of “scientists” curtailing the anxieties of “European consumers”, which would have been caused by their having “been bombarded with inaccurate information, half-truths, and wild scare-stories” by “anti-GM pressure groups” (2003, pp. 80-81).

The general picture, then, appears to be one of a basic conflict between the rational people, including policy-makers, their advisors, and scientists, who reject the “GM is unnatural” view, and the irrational “non-scientists” who endorse it. But is it

really so simple? It might be asked if those scientists who are not actively involved in the GM debate also believe that the “GM is unnatural” view is wrong.⁶

SCIENTISTS AND NON-SCIENTISTS TALKING ABOUT GM

We recently had the opportunity to examine the views of a small group of scientists who were not GM specialists as part of a novel public engagement exercise.⁷ Our study involved twelve participants. Six of the participants were academic scientists working at the University of Newcastle. The other six participants were non-scientists living in one of three wards within the city. The scientists were recruited using an e-mail to an existing university mailbase for academics with a research interest in the environment. The non-scientists were recruited through community groups and from a direct mailing to one hundred names randomly selected from the electoral register.

Most participants took part in six facilitated one-to-one conversations or “exchanges” (of up to an hour) over a period of six months. Each conversation was with a different member of the other group – so each member of the public met each scientist once. The six rounds of exchanges were on six different topics: local environment; genetic modification; climate change; energy; biodiversity and animals; and land use and the countryside. Participants were not asked to prepare for the

⁶ Previous research based on interviews with “thirteen UK scientists who had made public statements supporting or criticizing GM technology” found that scientists’ views on GM are by no means uniform, yet that “policy makers and regulators ... tend to discount diversity among the views of scientists” (Scott and Carr, 2003, p. 352, p. 349).

⁷ The “Deliberating the Environment” study was carried out during 2003-2004 by Derek Bell, Tim Gray, Mary Brennan, Nicola Thompson, and Jan Deckers, and funded by the “Science in Society Programme” of the ESRC.

exchanges. The facilitator's role in the exchanges was to promote conversation between the participants. The participants were encouraged at the beginning of the exchanges to talk to each other and ask each other questions. We were very happy to begin the session with a single question and allow the participants to set their own agenda for the remainder of the exchange. However, the facilitator had a schedule of questions and a selection of materials, such as short newspaper articles, maps, pictures and quotations, which she could use to prompt further discussion between participants. Therefore, the exchanges were able to (and did) vary between two extremes: participant controlled (unstructured by the facilitator) and facilitator controlled (participants acted more like respondents in a semi-structured interview). In most exchanges, the facilitator's prompts provided a loose framework for discussion between the participants. Before the first exchange and after the final exchange, we conducted semi-structured individual interviews with all of the participants. The interviews and exchanges were recorded and transcribed for analysis.

The small number of participants in the study makes generalisation to a wider population difficult. However, we believe that looking in detail at the views of our participants may be fruitful in developing more satisfactory interpretations and explanations of views that are commonly held, such as the "GM is unnatural" view and the critical response to it. In this paper, I focus on the five exchanges on GM and, in particular, on whether the participants regarded GM as unnatural.⁸ However, where it may contribute to our understanding, I also draw on views expressed by the participants in their initial interviews, in which we asked them what they understood by the concept of "nature". In what follows, I use pseudonyms to refer to the

⁸ One of the six planned exchanges on GM did not take place.

participants. For ease of reference, the scientists have been given names beginning with the letters A to E (Alice, Brian, Craig, David, and Eric) and the non-scientists names beginning G to K (Gail, Henry, Irene, Jane and Keith). Their conversations provided us with a good opportunity to examine three issues: (i) whether our scientists shared the views of “many promoters of GMOs and scientists” in the PABE study on the “GM is unnatural” issue; (ii) whether the non-scientists expressed the “GM is unnatural” view, or identified themselves, through speaking with scientists, with what Wynne has called the “prescriptive ontologies of human relations, human subjects and society” (2001, p. 479) which are tacitly embodied in conventional “scientific” approaches, and which might inhibit the expression of the “GM is unnatural” view; and (iii) how the debate on GM might benefit from these exchanges.

We found that three scientists rejected the “GM is unnatural” view. One, however, strongly endorsed it, and one was more ambivalent. All of the non-scientists apart from one expressed the view that GM is unnatural. The one non-scientist who did not accept the “GM is unnatural” view expressed agreement with her scientist exchange partner.⁹ Before addressing the non-scientists’ views, I shall first examine the issue of why some scientists rejected the “GM is unnatural” view in an attempt to throw more light on the view that the concerns of those who have objections to GM because of its unnaturalness are misplaced. The positions of Eric and Craig are presented as case studies of different perspectives on this view.

WHY DO SCIENTISTS REJECT THE “GM IS UNNATURAL” VIEW?

⁹ While Irene did not reject the “GM is unnatural” view explicitly, she did say, when Eric said that genes are being manipulated by humans, that “they’ve always done that”, providing the examples of hybrid roses and fruit trees that are grafted.

Eric presented the clearest account of this view:

“At the moment most people if you say genetic modification they think in terms of messing around with the genetic structures of plants and animals to produce all kinds of strange hybrid creatures and bizarre plants when it isn’t, it isn’t really like that. (...) It’s almost a form of accelerating what is normal genetic change that you produce through breeding say. (...) All of our different classes of dogs have arisen ... because we’ve selectively bred so in many ways we’ve manipulated the genetics, we’ve taken advantage of spontaneous change in the gene. (...) So it is nothing especially new, we’ve always introduced new crops into old environments ...we’ve always changed the landscape to accommodate None of our landscape is a natural landscape, it’s all been determined by new farming practices or bringing in new animals. (...) I don’t think Britain before the Romans came had cattle, dormice were still actively bred, we have, there are, we’ve always manipulated the environment in that way. (...) You’re going to the Middle East, you need more plants that will tolerate dry conditions, ... or colder conditions, all of those are potential benefits of genetic manipulation.”

While Eric suggested “the natural” could not be differentiated from “the unnatural” in his first interview, the concept of “naturalness” appears to make sense in the above quote. Presumably, it was understood in terms of a “landscape” that has not been changed by human interference. He then proceeded by pointing out that humans have interfered with nature for a long time. This seems to be the reason why GM was perceived to be just another technology which humans use to change their environment, like conventional breeding methods which preceded it. Since “what we perceive as nature in this country is largely man made” (a view also expressed in his first interview) the problem with those who hold the “GM is unnatural” view is that they fail to see that GM is “nothing especially new” as humans have always “manipulated the environment”.¹⁰ Yet Eric did not explain why he disagreed with the

¹⁰ In the first interview, Eric understood by wilderness “an area which has never been deliberately or systematically manipulated by man”, and also that this “can’t be a definition of nature” because “it

views of “most people”, as no explanation was provided why GM would be different from producing “strange hybrid creatures and bizarre plants”. Since new organisms are produced by GM, what “most people” may mean when they call these organisms “strange” or “bizarre” is simply that they stand apart from organisms that have been produced in conventional ways. A further issue is whether the view that GM is “almost a form of accelerating what is normal genetic change” is sufficiently accurate as a scientific account of what is distinctive about GM, in view of the different methods that are used to produce genetic change. Eric may doubt the accuracy of this view himself, since the word “almost” is used, and the contrast made with what is called “normal genetic change” suggests that GM is different in kind.¹¹

The most interesting account of the view that GM is a normal extension of conventional breeding methods comes from Craig, not least because his account provides clues to why the view may be held by some scientists. When his non-scientist exchange partner, Henry, said that he was against “anything which goes against nature”, Craig said that this was “not consistent”. Like Eric, Craig pointed out that GM may not be different from conventional ways of breeding, providing as an example the cross breeding of pigs and cattle which has been going on for hundreds of years. Craig also said that research had shown that there was no risk of GM material contaminating non-GM crops, and that using GM could be beneficial for biodiversity as it could lead to a reduction in the use of weed killers and pesticides, or the use of more benign forms of these. In spite of these claims, Craig clearly

hardly exists anymore”. He also said that “what we perceive as nature in this country is largely man made”, which was contrasted with the wilderness “in Tasmania”.

¹¹ The same uncertainty resounded in Alice’s words. Her phrase that “we’ve been manipulating the genetic make-up of things for a long time ... it’s just doing it quickly” was followed by the words “isn’t it?”.

appreciated Henry's position when Henry said he was against "anything which goes against nature". Craig even admitted that this is what he would say "as a non-scientist". While Craig said that he did "not really" have specific concerns about GM (when the facilitator asked him), he also said that he was against it, a position which made him feel uncomfortable: "I think as a scientist or researcher to say OK I'm against it because I don't like it ... is very difficult". When Craig put on his "scientific hat", he could not accept the view of those who object to GM on the basis of its alleged unnaturalness. Yet when Craig took off his "scientific hat", he found himself to be opposed to a technology without knowing or being able to articulate precisely why this might be the case. Perhaps, Craig believed that decisions about GM had to be based on more than strictly "scientific" issues, yet he felt at the same time that he had to discredit this belief when he put on his "scientific hat". In spite of the fact that Craig recognised that capitalist motives might be a strong driving force behind the development of GM, his belief in scientists was unshakable. When he was asked if scientists could be trusted to carry out research on GM, he said that this should be a basic premise, continuing: "we scientists are to find the truth ... so ... I totally say yes you have to trust them". Henry, by contrast, qualified his faith in scientists by saying that he trusted them as long as "they don't try to interfere too much (and) don't try to play God", and thought scientists might be doing this by "embryo cloning". While Henry provided Craig with opportunities to qualify his faith in scientists, he did not do so. And while Henry expressed doubt about the validity of the Farm Scale Evaluations on several occasions, Craig said he trusted Margaret Becket to make the right decisions based on them.¹²

¹² The Farm Scale Evaluations ("the trials") are a range of investigations at field level which were undertaken in the UK on the basis of an agreement between the UK Government and SCIMAC (the

The reason why Craig could not reconcile his ultimately negative verdict about GM with his status as a scientist may relate to what has been identified (and challenged) as the reductionist worldview of what counts as “scientific”. It comprises three basic tenets. The first tenet is the belief that risk assessment is a scientific activity, and that the issue of what defines as a “risk” is unproblematic. The views on risks held by the “non-expert” world are treated as “epistemically vacuous” (Wynne, 1996, p. 61). The second tenet is the belief that science can, in principle, account for all the risks and benefits that may be associated with a particular technology. Uncertainties are understood predominantly in terms of calculable probabilities and temporary setbacks. The final tenet is the belief that new technologies are not significantly different from old ones. The negative effects of these old technologies are either ignored or downplayed, and the new technologies presented as the next stage of “progress”. Associated with this is the belief that “the public” are always suspicious about new technologies initially, yet soon come to realise that their suspicion is misplaced (Levidow, 2001; Wynne, 1996 & 2001 & 2003). Taken together, these tenets amount to the view that the nonhuman world must be reduced to a collection of objects for human control, and that the only limits to objectifying the world to human control are temporary scientific uncertainties. As a “scientist” Craig appeared to be committed to the reductionist worldview but as a “non-scientist” his worldview was rather different.

Supply Chain Initiative on Modified Agricultural Crops), the organisation which represents the agricultural and biotechnology industry. They were held between 1999 and 2003 and involved four GM herbicide-tolerant crops: winter and spring varieties of oilseed rape, beet (fodder and sugar), and forage maize.

WHY DO SCIENTISTS HOLD THE “GM IS UNNATURAL” VIEW?

While Craig could not make sense of the “GM is unnatural” view “as a scientist”, a position which he shared with two other scientists, one of our participants was a scientist who endorsed this view strongly, without seeing it as conflicting with science. Little is known about the views of scientists who embrace the view that GM is unnatural, as many scientists who have either written or been interviewed on GM share the Nuffield Council’s position that the “‘natural/unnatural’ distinction is one of which few practising scientists can make much sense” (1999, p. 15 par. 1.40). Brian’s account provided us with data for a rare case study of a scientist who thought that GM is unnatural. My discussion of his view is supplemented by comparison with the views expressed by the non-scientists in our study. The non-scientists shared many of Brian’s concerns.

Brian expressed concerns related to the process, the outcome, and the attitudes of the researchers involved with GM. Firstly, if we focus on the process of genetic modification, Brian thought genetic modification involves “faffing round directly with the genes” or “messaging round”, which he valued negatively. GM was regarded as “qualitative(ly)” different from conventional breeding methods. Brian contrasted “technology” with “nature” in his first interview. By “nature”, he understood “the mountains and the woods and ... the sea”. This was contrasted with “what the journal Nature would think of”, which would be “molecular biology”. Brian was not opposed to “high tech” per se, yet he thought that it could distract us from understanding what really goes on in nature. Brian may have thought of GM as a “high tech” approach, while he thought of conventional breeding methods as less “high tech”. A similar theme was expressed by one of the non-scientists, Keith. However, while Brian spoke

of a “qualitative difference” between conventional (selective) breeding and GM, Keith contrasted natural selection with GM and said that the latter is “mucking around with the genes”.

Secondly, if we now focus on the outcomes of GM, Brian was clearly concerned about its potentially negative effects. In his first interview, Brian explained that one of the reasons for his relative lack of interest in “high tech” was the idea that we do not understand nature enough to manage it: “I think that our understanding of the natural world is so poor that ... high tech doesn’t even come on the scale”. Brian perceived GM as problematic because of its potential to make far-reaching changes in a poorly understood natural world. The use of GM technologies was perceived as a threat to the preservation of “a proper natural stock”. This was expressed as follows: “the sort of ... fear is that if you’ve got transgenic pollen as they call it, it’s been altered. That ... it’s going to mix with natural stock ... and then you’re never going to have a proper natural stock anymore. There’s always going to be, it’s going to be adulterated with this stuff that we’ve fuffed around with”. Another of the non-scientists, Jane, was also concerned with preserving “a nucleus of this good thing ... what we’ve got”. Yet she showed a greater readiness than Brian to welcome some applications, saying that “if they keep things to themselves like corn to make it shorter or fatter, that’s alright”. At the same time, she was “terrified” of shifting genes between organisms that are more distantly related, imagining a bird eating from a plant modified with something from a fish and “growing teeth like the shark it came from”.

Thirdly, and related to the previous point, Brian was concerned that GM scientists might be overconfident in their knowledge claims, and that this might lead to negative outcomes. This was articulated partly in terms of the question of whether

enough research had been done to make decisions about whether or not GM technologies should be used. Brian expressed this concern when he was asked to comment on the Farm Scale Evaluations. After saying that he had heard about them, yet that he did not know much about them, he said that he doubted their “comprehensiveness” and that “one field trial of anything is not enough to base a decision on”.¹³ Yet a more fundamental concern was expressed as follows:

“There’s the people who are the staunchest advocates of it, are keen to point out that we’ve always ... selectively bred things, to manipulate the gene pool, and to get a desired end result ... , you look at the variety of dogs there are ... we’ve deliberately selected and bred dogs with specific characteristics ‘til they end up with these phenomenal array of races within the same species ... just for our amusement really, and they go on to say well what’s the difference, in selecting genes like that and the way they’ve done it with agriculture ... cows apparently couldn’t live wild anymore ... cause we’ve bred and bred them, and interbred them until they’re dependent on the farming system, and ... well then the argument is ... why can’t you directly alter the genotype in order to get things to do what we want them to do. Erm, my feeling is that there is a qualitative difference in those two approaches inasmuch as if you’re faffing round directly with the genes ... you’re basically working on an assumption that you can ... accurately predict the consequences of messing round at that level ... with a fair degree of certainty, or with absolute certainty is what they tend to project when they’re talking about it in public. And I have to say that in every other sphere of science I’ve worked in, we don’t work with that level of certainty ... That’s my biggest concern ... that they present things in utterly cause and effect language which in all other spheres of science is largely debunked, and we tend to talk in terms of probabilistic outcomes, and I think there’s much more probability about it than these people want to admit. I don’t see why it

¹³ A similar concern was expressed by many participants from a range of social and professional backgrounds in a study with a range of focus groups in central Michigan on the issue of plant biotechnology and GM foods. The study reports that “many participants ... expressed concern that insufficient testing was sometimes occurring prior to product approval” (Beckwith et al., 2003, p. 102).

should be the only area of science that isn't subject to uncertainty ... I think it's less predictable ... than the staunch advocates would like you to believe.”¹⁴

What Brian expressed in these words is the view that either “the staunch advocates” of GM (or, perhaps, all GM scientists) differ from those who use conventional breeding methods and other scientists because they deny the possibility that uncertain consequences might result from genetic modification. Yet any scientific theory must be falsifiable, and its advocates must be open to the possibility that consequences might turn out to be different from what was predicted, thereby challenging the theory. Both GM and non-GM scientists should share this understanding of science. Why, therefore, would GM scientists deny the possibility that uncertain outcomes might be produced?

One possibility is that they simply overestimate the degree to which humans can predict the outcomes of natural events. Yet it is hard to see why this tendency should be manifested more amongst GM scientists than amongst other scientists. Another interpretation is that (some) GM scientists might have such strong interests in pursuing “certain” outcomes that they downplay or deny the possibility that uncertain and undesirable consequences might follow. In the context of writing on GM, Guy Cook has pointed out that the distinction between science and technology has “in recent years ... fallen by the wayside” (2004, p. 81). Cook has argued that the terms “GM” or “genetic modification” have contributed to the confusion as “the word ‘modification’ (like its abandoned precursor, ‘engineering’) is inherently

¹⁴ Several participants related these uncertainties to concerns about the spread of GM material to wild relatives or non-GM crops (in the words of David: “pollen could go miles” and “a bee doesn't know the farm edge”), the development of herbicide-resistant weeds, and biodiversity loss. These concerns were found also amongst those who regarded GM as a normal extension from conventional breeding techniques.

technological rather than scientific, referring to an activity rather than a field of knowledge” (2004, p. 82). A plausible interpretation of Brian’s views is that, while he was generally concerned about GM because of the process and its outcomes, he was especially concerned by those whom he perceived as denying the possibility that uncertain consequences might be produced by their actions. The commercial interests which the “staunch advocates” may have might undermine the scientific ideal of knowledge pursuit as a disinterested activity, and explain why some might claim to know the consequences “with absolute certainty ... when they’re talking about it in public”.¹⁵ Brian expressed his distrust of the motives of GM companies when he contested the claim that GM was a technology that would help the poor: “no amount of technological change will change injustice ... if Monsanto wanted to save the Third World it could always wind up its business and donate its proceeds to charity.”

Brian’s three concerns are clearly related. For him, and for four of our non-scientists, GM is unnatural because it is a technology that does not work with, but against nature. The natural order was understood as possessing its own teleology, and GM was perceived as an over-confident attempt to subject nonhuman nature to the external teleology imposed on it by humans, which would then be “adulterated”. Accepting the natural order and preserving its integrity were perceived as, *prima facie*, right. Attempts to change the natural order in radical ways (which GM was perceived to be doing) were perceived as failures to accept the natural order, and therefore, *prima facie*, as wrong. The general feeling was that there was wisdom within nature which could be trusted. An example is Brian’s remark that he saw “no case” for genetically modifying bacteria “to destroy the acidity of polluted mine

¹⁵ Most participants thought that commerce and greed might be powerful driving forces behind GM technology.

waters” as “the natural bacteria ... are absolutely fantastic”. His exchange partner, Keith, agreed that “nature has it right in the first place”. The question of whether or not we should develop and use GM was associated with a choice between two worldviews. The first view was that natural things possess their own purposiveness, which should be, by and large, left intact by humans. The second view was that natural things either are devoid of purposes, yet can be rendered with purposiveness by humans, or have their own purposiveness, yet that these purposes may legitimately be replaced with new purposes given to them by humans.¹⁶ The statements of Brian and the non-scientists who supported the “GM is unnatural” view can be interpreted as expressions of agreement with the former worldview. Perhaps, the clearest example can be found in Brian’s answer to the question of what he thought about modifying pets so that their fur won’t cause allergies: “I think that’s outrageous.”

The main concern about GM scientists was that their attempts to alter nature to accommodate it to human needs were perceived as “mucking around with nature”, “faffing around with genes”, “messaging with nature”, in other words as, *prima facie*, arrogant. This is also how the fear of Henry, who said that he was an atheist, has to be understood, when he said that he feared that scientists involved in GM may be trying

¹⁶ The philosophers McKibben, Raffensperger, and Sandler have expressed similar reservations about GM as the participants in our study who thought GM was unnatural. The disposition to manipulate and dominate nature is opposed to the disposition to adapt ourselves to nature (McKibben, 1999, p. 150 and Raffensperger, 2002, p. 133 and Sandler, 2004). Words like “arrogance” and “hubris” are used to characterise the former disposition, while the latter disposition is described as expressive of “humility”. Sandler has pointed out that humility is not justified simply out of fear of the likely consequences for humans and others that might result from dispositions which exhibit arrogance towards nature, yet that it “is justified by a proper understanding of ourselves and our relationship with the natural environment – an understanding that is significantly informed by the results of our past decisions” (2004, 309).

to “play God”.¹⁷ Even Alice, who showed a great deal of support for GM, recognised this as a concern. In the context of discussing the views religious people might have about GM, she remarked that GM is “kind of imposing our will over ... life in general”, adding that she thought “quite a number of religions” would be against “changing life purposely”. It is notable that this perception was shared by many participants in eight structured focus groups with a selection of population groups in the UK, held in 2001, on the genetic modification of animals. Commenting on participants’ views, Macnaghten summarises: “Plants and animals had evolved over millenia and to propose that one could ‘improve’ characteristics on a more or less ‘instantaneous’ basis appeared to some respondents as arrogant, as hubris and as likely to rebound on humans. The principles of ‘letting be’ and the sensed need for ‘humility’ appear to be powerfully endorsed in the discussions” (2004, p. 546).

DOES THE “GM IS UNNATURAL” VIEW EXCLUDE LIMITED SUPPORT FOR GM?

So far, I have argued that Brian and four of the five non-scientists in our study endorsed the “GM is unnatural” view. I have suggested that the view was not only multi-faceted but also underpinned by an implicit worldview. The account presented may have created the impression that those who held the “GM is unnatural” view rejected all GM applications. This was not the case. They did not subscribe to a simplistic “nature knows best” ideology, which would question all human attempts to

¹⁷ This is exactly what is claimed by one scientist in the context of defending genomics: “The fact is that we will have a power almost godlike” (Gee, 2001, p. 14 as quoted by Hendry, 2002, p. 188).

influence natural processes.¹⁸ Neither did we find support for Alison Shaw's interpretation of the views of ordinary UK citizens recruited from a variety of community groups (and interviewed on GM), namely that they held a rather romanticised picture of nature, with nature being regarded as fundamentally good and human intervention as inherently bad (2002). All participants felt that some interventions were justifiable, while others were not. Opponents of GM combined a general stance of being "against" GM with support for particular applications. How, then, can we reconcile the apparent conflict between general statements of disapproval with limited support for some applications? Put differently, does the sheer fact that those who expressed the "GM is unnatural" view embraced some GM applications not undermine the credibility of the "GM is unnatural" view?

To answer this question, we must consider which applications participants had in mind when they said that GM was wrong because of its unnaturalness. Most of them thought of agricultural applications, mainly herbicide-tolerant oilseed rape and maize. Other GM applications were less well-known. Yet when participants were asked to evaluate some other applications introduced by the facilitator, some were evaluated positively. The production of GM insulin for diabetics, for example, was evaluated positively by all participants. Brian approved also, with some reservations, of the production of transgenic pigs and the use of their organs by humans: "I suppose

¹⁸ Yet this is what some scientists seem to claim some non-scientists subscribe to. Gee, for example, writes, in the context of defending genomics, that "a sensible political strategy ... must ... not be overly swayed by the wilfully ill-informed-ban-everything mentality of those who wish to retrieve a golden age that never was" and that "the concerns of the anti-GM lobby ... are distracting" (Gee, 2001, p. 14 as quoted by Hendry, 2002, p. 88). A weaker account is presented by Halford, who reacts against "the popular notion that 'natural' is good and man-made is 'bad' when it comes to food" (Halford, 2003, p. 13).

if I was desperate for a heart ... I'd be prepared to overlook" animal welfare considerations. The data do not support the interpretation that participants felt they had to give up the "GM is unnatural" view once they were asked or told about GM applications which they felt they needed to support. Instead, they felt that GM was still unnatural, but that the wrongness of doing something that was perceived to be unnatural was outweighed by the benefits which could be derived. For example, with GM insulin, benefits were perceived for diabetics as they depend on an adequate supply of good quality insulin. Another relevant consideration was that the insulin-producing bacteria were perceived to be able to be confined to the lab, unlike many other applications. All felt that when a serious human need could be met by a particular GM application, and when there were either no alternatives or when alternatives were perceived to be more problematic, the negative value of doing something unnatural would be outweighed by the positive benefits. Participants varied somewhat, though, in which applications they were prepared to give their seal of approval. Because they could not see any serious benefits that might be derived from the production of GM herbicide-tolerant maize and soya, many disapproved of their commercialisation. In these cases, the wrongness of doing something unnatural was not outweighed by what were perceived to be dubious claims about potential benefits. GM was perceived as an illegitimate infringement of humans on the natural order, unless participants thought that serious human needs could be satisfied by changing the natural order through GM, and when these needs could not be satisfied by less problematic means. Sandler has interpreted such a position as follows: "Humility ... is one virtue among many, and on some occasions the course of action favored by one virtue is appropriately subordinated to the course of action favored by others" (2004, p. 310). A better interpretation of the views of our participants is not that they

subordinated the virtue of humility to some other virtue when they showed support for a particular application, such as the production of GM insulin. GM was not intrinsically linked with a lack of humility. It was only linked with a lack of humility if it was perceived as being done for the wrong reasons.

WIDER UNEASE WITH MODERN FARMING PRACTICES, OTHER TECHNOLOGIES, AND A WHOLE WAY OF BEING

As I have indicated, the reason why those who expressed the “GM is unnatural” view had negative perceptions about some, yet not all genetic applications, did not relate to a concern with genetic modification as such. Instead, their concerns were related to an underlying worldview, which they held to be problematic, and of which they thought some genetic applications were expressions. Therefore, it is not surprising that they frequently connected GM with different manifestations of this worldview, which they questioned also. Their views suggested that there are varying degrees of unnaturalness, depending on the different methods that humans can use to interfere with nature. While participants frequently struggled to define the word “nature” when they were asked to do so in their first interview, the lack of a clear definition did not deter them from using the words “nature”, “natural” and “unnatural”. How they understood these words has been articulated well by Cook: “Neither ‘natural’ nor ‘unnatural’ can be defined by a checklist of necessary features, but that is not to say that they have no meaning. They are words best understood by reference to prototypical instances. It makes sense to talk of degrees of naturalness, and to place different phenomena at different points along a continuum. Thus a plant growing in a wilderness is prototypically natural; a GM plant growing in a laboratory is

considerably less so” (2004, p. 99 and pp. 82-84). Many participants placed various technologies and practices somewhere on a continuum between naturalness and unnaturalness, and expressed more concern about those that were placed closer to the unnatural end of the spectrum. What is more, those participants who questioned the “GM is unnatural” view frequently questioned the same technologies and practices. In other words, they had common concerns that may reflect a similar worldview, but one that was repressed in discussions of GM.

One area of wider unease was particular farming practices of which some GM applications were perceived as being a part. In the exchange between Henry and Craig, Henry brought up issues of wider concern with farming practices. First of all, Henry answered the question of what he understood by GM and what he thought of it as follows: “I’m just dead against it, as I said before I was brought up on farms in the old fashioned manure on the fields and things. I think it’s wrong to mix things up, it’s going against nature ... It’s just strong feelings. I’m anti GM, I don’t know what mutants is, but I’m anti.” While his concern that it may be “wrong to mix things up” resembles Brian’s concern about keeping “a proper natural stock”, when Henry was then asked by Craig if he opposed the breeding of cattle by conventional means, Henry’s response indicates that his concern about GM was part of a wider unease with some modern farming methods which he deemed to be unnatural, and therefore morally problematic. Henry used the following words: “I’m against these ... factory farms for the hens and things like that, conditions for pigs ... just chained up all the time, or in little cages, it’s not nature, it’s not natural ... it’s just for breeding purposes or food purposes really ... you get these fat hens and fat cows and things and pigs, it’s cruelty as far as I’m concerned.” The connection between genetic modification and factory farming is that Henry perceived both to be products of the same philosophy of

strong anthropocentrism, an approach that conceives of the value of the nonhuman world primarily in terms of its use value for humans.¹⁹ Henry questioned this approach not only because of the cruelty it inflicts on nonhuman animals, yet also because of the unease he felt with an approach that he perceived as going too far in instrumentalising the nonhuman world to human purposes. Henry's concern with practices that reduce the value of parts of the nonhuman world to their value for human "food purposes" was also expressed by Eric, the scientist who most clearly rejected the "GM is unnatural" view. Eric spoke negatively about some practices which were perceived to reduce the aesthetic value of the environment and the value of the environment for nonhuman animals. While he thought that a potential benefit of GM crops that are tolerant to broad-spectrum herbicides may be higher yields or cleaner crops that are easier to harvest, he said that he preferred to eat products from fields which had provided food for (nonhuman) animals at the same time, even if the quality of the food would be worse. Eric associated negative perceptions (including, for example, that the absence of barriers in monocultures could facilitate the spread of disease) with "complete monoculture system(s)" and areas that are "completely lifeless", providing the example of maize fields he had seen in America: "the thought of that being an almost sterile environment, ... it's pretty boring".

The right way forward, for Henry, was to develop organic farming, which was also supported strongly by Craig. Henry connected organic farming to the way he was brought up, which he connected with "nature" and "cleaning the byres out and ... spreading it onto fields and things like that", and which he held to be "a healthier world". What Henry seemed to express is the view that farming is about more than producing goods for the market. It is also about a whole way of being; a personal way

¹⁹ For a more elaborate account of strong anthropocentrism, see Deckers, 2004.

of relating to the environment. The suggestion is that the value of relating to farm animals (whilst “cleaning the byres out”) and to the wider environment in a personal way is threatened by modern farming methods.²⁰ Recently, Verhoog and others have argued that there is a justifiable connection between “naturalness” and organic farming, and even that the concept of “naturalness” can be used to distinguish organic agriculture from conventional agriculture. They hold that organic farming is “closer to nature” (2003, p. 46) if it involves more than not using synthetic inorganic substances from the conviction that organic food is healthier, and also includes two further components. The first one is what is called an “agro-ecological approach”, which regards self-regulation and integration of agricultural activities into nature as important principles (opposing the tendency of conventional farming to increase human independence of nature). The emphasis would be on working with nature rather than fighting against it, and on preventing problems through increasing our knowledge of ecological processes. The second component is what is called the “integrity approach”, which assigns great importance to the value of respect for life and to conceiving of “natural entities as partners of humans”. On this approach, what is natural refers to “taking into account the characteristic nature of plants, animals, and ecosystems because nature has intrinsic value” and to “an inner process of involvement with the way of being of natural entities” (2003, pp. 43-44).

The reason why many participants were wary about GM related to the feeling that those who drive GM, and many other technological innovations, are so strongly

²⁰ Interestingly, those who participated in two citizens’ juries (in Hertfordshire and Tyneside) that deliberated on GM crops in the summer of 2003 also associated positive values with organic farming and wanted more support for it, and the Tyneside Jury shared with Henry a concern about animal welfare and a concern that GM might destroy the positive relations that exist between farmers and their land (Policy Ethics and Life Sciences Research Institute, 2003, p. 2, p. 10, p. 16).

committed to the philosophy of subjecting the nonhuman world to human ends that they underestimate the risks involved or downplay them. They were also concerned that the innovators defined risks and benefits primarily in terms of short-term profit and yield (for humans) and failed to take into account the long-term risks, including the risks involved for nonhuman life.²¹ For example, Henry's response to Craig's claim that "there were studies ... which show that ... pollen cross contamination ... will not happen" was: "Looks good on paper but will it really work? ... I'm doubtful". As many participants' distrust related to the attitudes and motivations of the innovators rather than to the technologies themselves, more information could not restore their lack of confidence. A good example came up in the exchange between Craig and Henry. When Craig said that Henry "should be in favour of GM food because with GM food you could use less ... weed killers or pesticides", Henry replied: "Yeah but they're stronger weed killers, aren't they, ... they'll have an

²¹ David, for example, said that Monsanto had sold more weedkiller in Canada, yet that the crops had not become any bigger. Donald Bruce provides another example of such a conflict between the respective values of promoters and others. When Monsanto planned the introduction of GM soya from the USA into Britain in the 1990s, they did not consider labelling to be necessary given the product had met the regulatory requirements. In this way, the possibility that the British public might perceive risks where Monsanto could see none was ignored, as well as the possibility that the public might incorporate notions in their definition of risk that went beyond the question of whether or not GM soya was "substantially equivalent" with non-GM soya, for example concerns with biodiversity (2002, 76-77). Further, in a series of interviews with lay people in the UK, Shaw also found that experts were perceived to be failing to take into account the long-term environmental and health impacts (2002). This view might have been shared by participants in two citizens' juries (in Hertfordshire and Tyneside) that deliberated on GM crops in the summer of 2003 as they called for long-term studies to assess the potential for harm from the cultivation of GM crops (Policy Ethics and Life Sciences Research Institute, 2003, p. 1).

adverse effect on natural animal life.” He also countered Craig’s suggestion by saying that pollen could spread into the wild and on the fields of farmers who would not want it. Henry admitted that he did not know much about the technology as such, yet he was convinced that the use of broad-spectrum herbicides applied to GM crops could lead to animals being “poisoned”, and made a connection with some consequences that have resulted from conventional farming methods: “there’s a lot of birdlife disappeared from what I can see ... When I’m walking around, to what it used to be when I were ... as a kid, there was any amount of birds, and they are getting less and less. Even the common house sparrow’s getting less.”

Many other references were made to things that had gone wrong in the past to express distrust in those who develop, use, and regulate technological innovations. Gail, for example, related her doubt about whether the potential consequences of GM could be predicted with sufficient accuracy to her perception that people had changed their views about insecticides after a re-evaluation of their effects: “Cause it’s happened with other things hasn’t it when they’ve got rid of insects that have attacked vegetables and the thing that they put in to get rid of ... turns out to be worse than the problem you already had.” This is why she said that she found it “hard to believe” the scientists involved with GM, “because so many things are put forward to the general public that it’s good for you and then a few years down the line it’s not so good” (providing also the example of cigarettes). This theme was picked up on by, her exchange partner, Alice. While Alice did not express a lack of faith in scientists, she did express a concern with “cascading effect(s)”, in particular with bad effects resulting from something intended to be good, which made her question what happens “to the plant (and) the things that feed on the insect” when insect-resistant plants are created. Irene, the non-scientist who was least supportive of the “GM is unnatural”

view, provided another example by relating her fear that GM crops might lead to a reduction of interest in crop rotation, which she valued positively, to losses of top soil that have occurred in the past. She referred to “what happened in America with the cotton and the dustbowl ... well they grew cotton and cotton and cotton and then in the end they couldn’t grow anything ... leached everything out of the soil”. She even “wonder(ed) what happened to the desert (...) you read about in the Bible and how it was all lush and green and now it’s under the sand”. The underlying concern was that some events (such as desertification) which humans might not normally hold themselves to be responsible for, might nevertheless have been produced by humans. The message for promoters of technological innovations is clear: we must be careful not to underestimate the impact which humans have on their environments.

While the focus in what precedes has been on the perception that GM and other farming methods were problematic because they were perceived to be embedding the wrong values, this wider unease with modern technologies and practices was by no means restricted to farming methods. Another example of this wider unease is the fact that some participants connected GM with cloning, which was perceived negatively.²² Like the scientists involved with GM, those involved with cloning were perceived as having an inadequate understanding of what is acceptable. This was also found in the PABE study, which reported that members of the public frequently mentioned cloning alongside GM, and interpreted this as a sign of both being “considered to be part of the same technological trajectory” (Marris et al., 2001, p. 59). Eric made another connection. In spite of the fact that he said, cautiously, that

²² In a range of open interviews with people in Germany, held between 1995 and 1997, the cloning of human beings was also often mentioned by participants when they were asked to speak about genetic engineering. It was evaluated very negatively (Zwick, 2000, p. 275).

transplanting hearts from transgenic pigs into humans might be acceptable, he questioned his approval in the following way: “the ethical issue is whether you should genetically manipulate a pig, or something like that specifically to produce a heart ... so that the pig can be killed and the heart can be taken out ... we forget the fact that we kill animals”.

CONCLUSION

Because the underlying unease with GM was not related to GM as such, yet to a particular approach to nature which was thought to be problematic, we have to cast serious doubt over the widely held view, especially by stakeholders in the GM debate, that people would be more supportive of GM if only they knew more about genetics (e.g. Halford, 2003, p. vi, pp. 80-81 and Simon, 2003, p. 6, p. 25 and Annerberg, 2003, pp. 17-18 and Dale, 2003, p. 21 and Shaw, 1999, 12.1, 12.2, and 13.4).²³ In fact, the GM Nation study found that people developed “harder ... attitudes and more intense ... concerns” about GM the more they engaged with the issues (GM Public Debate Steering Board, 2003, p. 51). While the seventy-seven participants in the “narrow-but-deep sample” (who participated in ten closed discussion groups representing a cross-section of members of the UK public and acted as a control on the self-selecting participants in the open debate) became more accepting of some applications, including some medical benefits and potential advantages of GM crops for developing countries, they became less willing to accept other GM applications

²³ Similar criticisms of this view have been expressed in other studies. See for example Marris et al., 2001, pp. 79-80; Rogers-Hayden & Campbell, 2003, p. 528; Shaw, 2002, p. 278; Madsen et al., 2002, p. 66; Beckwith et al., 2003, pp. 105-106 (yet see also p. 108 for a different perspective).

and expressed more concerns about all the identified risks (2003, pp. 42-44). Also, in a range of in-depth interviews with ordinary UK citizens, Shaw found that the most highly informed expressed the most opposition to GM (2002, p. 278).

The findings of our study are that some (especially, yet not exclusively) scientists claim that GM is a normal extension from conventional breeding methods. They have a problem with the view that GM is unnatural because of the difficulty to differentiate what is natural from what is unnatural. However, some scientists, such as Brian, endorse the “GM is unnatural” view, while even those who reject it, such as Eric, frequently have an unacknowledged understanding that there is a difference between the “natural” and the “unnatural”. The claims of those who subscribe to the “GM is unnatural” view are often dismissed, yet an examination of this position reveals that there are many concerns which are shared by both its adherents and its critics. These concerns, however, are belittled and repressed by those who subscribe to a reductionist “scientific” worldview. Eric and Craig felt uncomfortable, even torn, between this worldview and the worldview underlying the “GM is unnatural” view. However, almost all participants also recognised that some GM applications might be acceptable because of the clear benefits involved. Given the importance which many participants attach to the fundamental question of which place humans should occupy within nature, the hostility which many scientists, policy advisors, and policy-makers have shown towards the “GM is unnatural” position must be regretted, precisely because the underlying anthropological and ethical issues of the “scientific” worldview are problematised by this view. Halford has suggested that “genetic modification ... is no longer a new technology” and that “eventually the debating has to stop, conclusions have to be drawn and decisions made” (2003, p. 104). Precisely because many scientists, policy advisors, and policy-makers fail to listen to and

misrepresent the concerns of those who problematise the worldview that underlies GM and other technologies, my hope is that the debate may continue and that, for some, it may start.²⁴

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REFERENCES

Annerberg, R., 'The Present Status of the Use of Genetically Modified Crops in the EU – the Current Situation and a Vision for the Future,' *Acta Agriculturae Scandinavica, Section B, Soil and Plant Science* (Supplementum 1) 2003, pp. 14-18.

Beckwith, J. and T. Hadlock and H. Suffron, 'Public Perceptions of Plant Biotechnology – A Focus Group Study,' *New Genetics and Society* 22 (2003), pp. 93-109.

²⁴ A different study examining in-depth interviews with forty-three "GM scientists, non-experts, and other stakeholders in the GM debate" revealed some of the discursive features and strategies used by these actors in the debate, which serve to legitimate "scientific" discourse and to discredit, undermine (and silence?) the views of those who bring different meanings to the debate (Cook et al., 2004, p. 433, p. 436).

- Bruce, D., 'GM Ethical Decision Making in Practice,' *Ethics in Science and Environmental Politics* 2002, pp. 75-78.
- Cook, G., *Genetically Modified Language* (London, New York: Routledge, 2004).
- Cook, G. and E. Pieri and P. Robbins, 'The Scientists Think and the Public Feels: Expert Perceptions of the Discourse of GM Food,' *Discourse and Society* 15 (2004), pp. 433-449.
- Cooley, D. & Goreham, G., 'Are Transgenic Organisms Unnatural?,' *Ethics and the Environment* 9 (2004), pp. 46-55.
- Dale, P., 'Genetically Modified Crops and Risk Assessment in the UK,' *Acta Agriculturae Scandinavica, Section B, Soil and Plant Science Supplementum* 1 (2003), pp. 19-21.
- Deane-Drummond, C. and R. Grove-White and B. Szerszynski, 'Genetically Modified Theology: The Religious Dimensions of Public Concerns about Agricultural Biotechnology,' in C. Deane-Drummond and B. Szerszynski (eds.), *Re-ordering Nature. Theology, Society and the New Genetics* (London: T&T Clark, 2003), pp. 17-38.
- Deckers, J., 'Christianity and Ecological Ethics. The Significance of Process Thought and a Panexperientialist Critique of Strong Anthropocentrism,' *Ecotheology* 9 (2004), pp. 359-387.
- DEFRA, *The GM Dialogue. Government Response* (London: DEFRA, 2004).
- Gee, H., 'Futurology: What Next?,' *Guardian* (June 26, 2001) p. 14.
- GM Public Debate Steering Board, *GM Nation? The Findings of the Public Debate* (London: Department of Trade and Industry, 2003). (<http://www.gmnation.org.uk>)
- Grove-White, R. and P. Macnaghten and S. Mayer and B. Wynne, *Uncertain World. Genetically Modified Organisms, Food and Public Attitudes in Britain* (Lancaster: Centre for the Study of Environmental Change, Lancaster University, 1997).
- Halford, N.G., *Genetically Modified Crops* (London: Imperial College Press, 2003).
- Hendry, C., 'Science, Industry and the Laity. Towards a Knowledgeable Society for Biotechnology,' *New Genetics and Society* 21 (2002), pp. 177-198.
- Levidow, L., 'Utilitarian Bioethics? Market Fetishism in the GM Crops Debate,' *New Genetics and Society* 20 (2001), pp. 75-84.
- Macnaghten, P., 'Animals in Their Nature. A Case Study on Public Attitudes to Animals, Genetic Modification and Nature,' *Sociology* 38 (2004), pp. 533-551.

Madsen, K. and P. Sandøe and J. Lassen, 'Genetically Modified Crops: A US Farmer's Versus an EU Citizen's Point of View,' *Acta Agriculturae Scandinavica, Section B, Soil and Plant Science Supplementum 1* (2002), pp. 60-67.

Marris, C. and B. Wynne and P. Simmons and S. Weldon, *Public Perceptions of Agricultural Biotechnologies in Europe*, 2001 (http://www.lancs.ac.uk/depts/ieppp/pabe/docs/pabe_finalreport).

McKibben, B., *The End of Nature*, 2nd edn. (New York: Anchor Books, 1999).

Nuffield Council on Bioethics, *Genetically Modified Foods. The Ethical and Social Issues* (London: Nuffield Council on Bioethics, 1999).

Nuffield Council on Bioethics, *The Use of Genetically Modified Crops in Developing Countries* (London: Nuffield Council on Bioethics, 2003).

Policy Ethics and Life Sciences Research Institute, *The People's Report on GM Crops* (Newcastle: PEALS, 2003).

Raffensperger, C., 'Learning to Speak Ethics in Technological Debates,' in B. Bailey and M. Lappe (eds.), *Engineering the Farm: Ethical and Social Aspects of Agricultural Biotechnology* (Washington: Island Press, 2003) 125-133.

Rogers Hayden, T. & Campbell, J., 'Re-negotiating Science in Environmentalists' Submissions to New Zealand's Royal Commission on Genetic Modification,' *Environmental Values* 12 (2003), pp. 515-534.

Sandler, R., 'An Aretaic Objection to Agricultural Biotechnology,' *Journal of Agricultural and Environmental Ethics* 17 (2004), pp. 301-314.

Scott, M. & Carr, S., 'Cultural Theory and Plural Rationalities: Perspectives on GM among UK Scientists,' *Innovation* 16 (2003), pp. 349-368.

Shaw, A., 'What Are 'They' Doing to Our Food? Public Concerns about Food in the UK,' *Sociological Research Online* 4:3 (1999). (<http://www.socresonline.org.uk/socresonline/4/3/shaw.html>)

Shaw, A., 'It Just Goes Against the Grain. Public Understandings of Genetically Modified (GM) Food in the UK,' *Public Understanding of Science* 11 (2002), pp. 273-291.

Simon, W., *The Agricultural Advantages and Consumer Acceptance or Otherwise of Genetically Modified Crops with Particular Emphasis on Potatoes* (Blaston: Nuffield Farming Scholarships Trust, 2003).

Wynne, B., 'May the Sheep Safely Graze? A Reflexive View of the Expert-Lay Knowledge Divide,' in S. Lash and B. Szerszynski and B. Wynne (eds.), *Risk, Environment, and Modernity. Towards a New Ecology* (London: Sage, 1996), pp. 44-83.

Wynne, B., 'Creating Public Alienation: Expert Cultures of Risk and Ethics of GMOs,' *Science as Culture* 10 (2001), pp. 445-481.

Wynne, B., 'Interpreting Public Concerns about GMOs – Questions of Meaning,' in C. Deane-Drummond and B. Szerszynski (eds.), *Reordering Nature. Theology, Society, and the New Genetics* (London, New York: T&T Clark, 2003), pp. 221-248.

Zwick, M., 'Genetic Engineering: Risks and Hazards as Perceived by the German Public,' *New Genetics and Society* 19 (2000), pp. 269-281.

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