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Public Bill Committee

GENETIC TECHNOLOGY (PRECISION BREEDING) BILL

Fourth Sitting

Thursday 30 June 2022

(Afternoon)

CONTENTS

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Monday 4 July 2022

The Committee consisted of the following Members:

Chairs: Esther McVey, † Graham Stringer

Bowie, Andrew *(West Aberdeenshire and Kincardine)* (Con)
† Brock, Deidre *(Edinburgh North and Leith)* (SNP)
† Churchill, Jo *(Parliamentary Under-Secretary of State for Environment, Food and Rural Affairs)*
† Clarke-Smith, Brendan *(Bassetlaw)* (Con)
Duguid, David *(Banff and Buchan)* (Con)
† Fletcher, Katherine *(South Ribble)* (Con)
† Glindon, Mary *(North Tyneside)* (Lab)
† Green, Kate *(Stretford and Urmston)* (Lab)
† Howell, John *(Henley)* (Con)
† Jenkinson, Mark *(Workington)* (Con)
† Johnson, Gareth *(Dartford)* (Con)
Jones, Fay *(Brecon and Radnorshire)* (Con)
Jones, Ruth *(Newport West)* (Lab)
Lewis, Clive *(Norwich South)* (Lab)
† McCarthy, Kerry *(Bristol East)* (Lab)
Shelbrooke, Alec *(Elmet and Rothwell)* (Con)
† Zeichner, Daniel *(Cambridge)* (Lab)

Huw Yardley, Abi Samuels, *Committee Clerks*

† attended the Committee

Witnesses

Penny Hawkins, Head, Animals in Science Department, RSPCA

Lawrence Woodward OBE, Director, Beyond GM/A Bigger Conversation

Pat Thomas, Director, Beyond GM/A Bigger Conversation

Dr Michael Edenborough QC, IP law specialist, Serle Court

Professor Sarah Hartley, Associate Professor, University of Exeter

Ed Barker, Head of Policy & External Affairs, Agricultural Industries Confederation

Paul Temple, Farmer, Member of the Science for Sustainable Agriculture advisory group

Ross Houston, Director of Innovation, Benchmark Genetics

Professor Wendy Harwood, Senior Scientist and member of The Advisory Committee of Novel Foods & Processes, John Innes Centre

Professor Cathie Martin MBE FRS, Research Group Leader, John Innes Centre

Nigel Moore, Head of business development and strategy, KWS (ex-chairman of the British Society of Plant Breeders)

Professor Mario Caccamo, Chief Executive, NIAB

Public Bill Committee

Thursday 30 June 2022

(Afternoon)

[Graham Stringer *in the Chair*]

Genetic Technology (Precision Breeding) Bill

Examination of Witness

Penny Hawkins gave evidence.

2 pm

The Chair: The Committee is now sitting in public and the proceedings are being broadcast. We will now hear oral evidence from Penny Hawkins, head of the animals in science department at the Royal Society for the Prevention of Cruelty to Animals, who is now before us on Zoom—welcome. Would you like to introduce yourself? We will then move straight to questions.

Penny Hawkins: Good afternoon. I am Dr Penny Hawkins. I am a biologist by training. I am head of the RSPCA animals in science department, which seeks to implement replacement, reduction and refinement with respect to animal experiments, and to ensure the robust ethical review of animal use.

The Chair: Thank you. We will be finishing at 2.20 pm, so Members should keep their questions brief, and answers should be as precise and brief as possible.

Q174 The Parliamentary Under-Secretary of State for Environment, Food and Rural Affairs (Jo Churchill): Welcome, Penny, to this afternoon's session. Can you briefly outline what protections are in place for the welfare of animals, more specifically farmed animals, which were the source of concern this morning? Can you elaborate on whether you are reassured that all precision-bred lines for animals will be developed under the Animals (Scientific Procedures) Act 1986 controls assessing the ethics of the approach? In addition, what else would you like to see? Where do you think the Bill does well and where do you perhaps think there are more challenges?

Penny Hawkins: Right, there were quite a few components to that question, so if I start to go off topic, do please bring me back. I will start by saying that my area of expertise is the Animals (Scientific Procedures) Act 1986, so while I am aware that there are various pieces of legislation and codes of practice that regulate how farmed animals are kept and what it is permissible to do to them—of course, the Animal Welfare Act 2006 comes into play if farm animals are cruelly treated—what I really know about is the 1986 Act.

That was a major concern for the RSPCA, because when you look at the draft Bill, there is actually no mention at all of the Animals (Scientific Procedures) Act, which I will call ASPA for short from now on. The drafting team kindly gave us some of their time, so I now understand that every new line—every new precision-bred line that is created and that will then go on to fall under this Bill—will still require licensing under the ASPA for the foreseeable future.

That is absolutely essential, because within the ASPA, you have a framework for minimising the harms to animals, for reducing or avoiding wastage, and for ensuring that gene edited animals are properly characterised or phenotyped, so you understand the physical impact on the animal. There are also proper requirements for welfare assessment and, very importantly, a harm-benefit analysis and ethical review of every line, as you mentioned. In cases of special ethical animal welfare or societal concern, there is the provision to ask the Animals in Science Committee to review the project licence application, which is also critical.

The key reason why the harm-benefit analysis is essential is that at the moment, as drafted—and as previous people who have appeared before the Committee have explained—there is nothing in there about permissible purposes, less permissible purposes or purposes that should be really carefully scrutinised. So I think the ASPA is and will remain an essential safeguard to ensure that there is proper risk minimisation for animals, ethical review, and an element of social licence to use these techniques. People have to remember that the public need to consent to this, and at the moment, there are deep-seated public concerns that have not been properly explored.

Jo Churchill: Thank you; that is really helpful.

Q175 Daniel Zeichner (Cambridge) (Lab): Good afternoon and thank you, particularly for your written evidence and for the points that you have just made about ASPA. I want to follow on from that slightly, in relation to laboratory animals. I do not think we have really talked about that at all so far in the evidence sessions and I wonder whether you could say a little about it. Could you also comment on the overall framework of protection and, in particular, where the Animal Sentience Committee might fit in with regard to some of this? We are slightly concerned that it seems that the Bill could be on the statute books before the Animal Sentience Committee is even established.

Penny Hawkins: Indeed. I think some very useful lessons can be learnt from the way in which genetically altered laboratory animals are regulated, but I emphasise that, within a laboratory setting, genetically altered laboratory animals include those in which genes have been inserted from other species. We are very clear that within this Bill we are talking just about gene editing and not about deliberate transgenesis, although there have been some discussions about potential accidental additions of exogenous material.

When genetically altered animals are created under the ASPA, a licence is required for their creation, because, obviously, regulated scientific procedures are required in order to generate these animals—procedures that relate to, for example, administering substances to animals so that they produce large numbers of eggs, or super-ovulation, removing those eggs from animals, preparing other animals to receive the gene edited pregnancies, and so on. All those require licensing, and then, when the line of genetically altered animals has been created,

they have to be, as I mentioned, phenotyped. That is a battery of behavioural and biochemical tests to look at what the eventual genetic alteration was and to look at the whole animal that this creates—the phenotype.

There is a system of licensing under which the impact on the animal is categorised as mild, moderate or severe. If a researcher or research team can demonstrate that the gene edit they have done is stable for at least two generations, and if they have phenotyping data and animal welfare assessment data to demonstrate that the animal is not going to suffer as a result of being gene edited—the impact would have to be what is referred to as below threshold; not even mild suffering—then, in those circumstances, they can apply for the breeding of that particular line to be released from the controls of ASPA. That would mean that those animals would still be bred in a laboratory under all the codes of practice that normally apply to laboratory animals, but a licence would not be required in order to breed the animals, because there is no risk to their welfare because of the gene edit.

Those are the safeguards in place for laboratory animals. The issue with farmed animals is that, obviously, if they are released from ASPA and their breeding is then controlled or regulated by this PB legislation, they will not be held in a laboratory setting, with all the controls that that entails; they will join the national herd or flock. That is a very different environment, and it can be far from clear how the genes will express themselves once they are in that environment.

Also, this Bill presumably applies to other animals: companion animals, wild animals and sporting animals. At the moment, for example, projects are under way to look at gene editing grey squirrels to result in fewer females being born or male infertility. Presumably, their breeding will also be covered by the Bill. And when they are released, they really will be released into the wild. Again, that is an extremely different environment. So the safeguards that laboratory animals have will be severely reduced or absent for other types of animal.

Q176 Daniel Zeichner: What would be needed in the Bill to safeguard against the issues that you have just raised?

Penny Hawkins: Well, I was listening to the representations this morning and I can only echo what everybody was saying about the welfare advisory body. At present it is there to report to the Secretary of State on whether the notifier has had regard to the risks to the health and welfare of the animal and their progeny. There does appear to be some provision in clause 15 on the suspension and revocation of marketing authorisation. That provides for the Secretary of State to receive information on the health and welfare of the progeny of those animals, but that is dependent on clause 14 on reporting obligations, which states only that:

"Regulations may make provision for requiring the notifier…to provide the Secretary of State with…information"

about their progeny

"during periods…prescribed by the regulations".

All those elements that relate to long-term surveillance really need to be tightened up, and they need to be "musts" instead of "mays". Many of those are subject to the affirmative procedure, which I know is normal for statutory instruments, but that again does not reassure people who are concerned about the long-term welfare effects that an adequate mechanism is in place for picking these up.

Similarly, it is not at all clear what qualifications the inspectors who are going to be active under the Bill need to have, so it would be good to see some reassurance as to how they are going to be qualified and to see it explicitly said that they will have the right to access and inspect animals.

Q177 Deidre Brock (Edinburgh North and Leith) (SNP): Thank you for coming along to speak to us this afternoon. The RSPCA has raised concerns about the safety of gene editing, stating:

"There is no history of safe and reliable use".

What else could that cover? What are your concerns? Can you expand on that, please?

Penny Hawkins: Just to clarify, when we talk about safety we are talking about the safety of animals. There are two kinds of concerns about gene editing: one from the consumer point of view and one from an animal welfare point of view, and we are talking about the animal welfare point of view. I listened particularly to Professor Henderson when he spoke to you, and I noted that he said there will have to be a two to three-year process of gathering and analysing scientific evidence around both on-farm and off-farm welfare

"before the secondary legislation can be enacted."—[*Official Report, Genetic Technology (Precision Breeding) Public Bill Committee,* 28 June 2022; c. 17-18, Q24.]

He said that the process for that was laid out in the Bill, but I have looked at the Bill really carefully and I cannot see any such process either in the Bill or the explanatory notes.

This morning Professor Henderson said that more thinking needed to be done regarding animal welfare advisory bodies and advice on the Bill. Coming from the DEFRA chief scientific adviser, I do not think that that is very reassuring. All of the concerns that I expressed previously about the longitudinal reporting and monitoring of health and welfare also apply here. I am particularly thinking about clause 9, which explains what happens from the bureaucratic aspect if an animal is no longer deemed to be precision bred. Presumably if an animal is no longer deemed to be precision bred, it will either be because they have not been characterised or phenotyped properly or because the genome is no longer stable.

As you heard from the Royal Society of Biology, genes can have effects in multiple tissues, so in these cases there must be a much clearer mechanism for identifying and tracing these animals, and that is also lacking in the Bill. From an animal safety and welfare perspective, there really are some issues that need to be addressed.

Q178 Deidre Brock: You mentioned ASPA. What are your thoughts on the potential conflicts between this legislation and the Animal Welfare (Sentience) Act 2022?

Penny Hawkins: That is an extremely important question. Reading the sentience Act, I do not think it will necessarily preclude gene editing per se. What it requires is an examination of whether or to what extent the Government are having or have had all due regard to the ways in which the policy might have an adverse effect on the welfare of animals as sentient beings. At the moment it is simply not possible to say that on the basis of the information in the draft statute.

Clause 12 talks about the welfare advisory body reporting to the Secretary of State on whether the notifier has had regard to the risks to the health or welfare of the animal or their progeny and has taken "reasonable steps" to identify or address them. But we do not know how the welfare advisory body will be constituted or resourced, how independent it will be, what kind of expertise it will have access to, whether it will just confine its assessment to looking at those particular traits that have been identified by the notifier or whether it will think about wider issues relating to the process of gene editing, as Professor Campbell said, looking at purposes or at the global impact of gene editing those animals. So it is not possible to say from the way the statute is drafted at the moment whether all due regard has been paid. We just have to hope that the secondary legislation will address this, but at the moment we just don't know.

Q179 Deidre Brock: I have seen criticism that the Bill is too focused on enabling the commercial opportunities inherent within gene editing, rather than focusing sufficiently on animal welfare, for example. Would you agree with that, looking at the Bill as it is drafted at the moment?

Penny Hawkins: Yes, because even the animal welfare applications are ultimately for human benefit. If you think about the gene edited polled cattle, which are the poster child for the animal welfare applications, clearly polling cattle is extremely painful and distressing for them. A world in which that did not have to happen would certainly be a better world for the cattle, but it is actually possible to keep horned cattle together. It can be done, but it is very expensive. Many farmers would not be able to afford it and many consumers would be unwilling, or probably unable, to pay the prices that would be involved. So, yes, there is a welfare benefit, but it is ultimately an economic benefit.

Q180 Kerry McCarthy (Bristol East) (Lab): Could I just press a little more about the Animal Sentience Committee side of things? We are now in the position where there is the welfare advisory body under this legislation, the Animal Sentience Committee and all the licensing regimes under the Animals (Scientific Procedures) Act 1986. Do you think it would be better if this was all merged into one organisation? We also heard about the codes that apply in terms of farm animal welfare, some of which is legislative and some of which is guidance. Is it not all a bit messy?

Penny Hawkins: No, I do not think it is messy. The Animal Welfare Centre of Excellence, which will bring all these committees together, will ensure co-ordination. The purpose of the Animal Welfare (Sentience) Act 2022 is to look at policy across all policy areas and see whether due regard has been paid to the effects on the welfare of animals as sentient beings. The welfare advisory body is something that the Animal Sentience Committee would look at when it was making that assessment. I still think it is really important to have this overarching body that will look at policy right across the board. To me, they are all separate entities that complement one another.

Q181 Kerry McCarthy: Do you not worry that things would get lost in the mix, and that something might be seen as the responsibility of one body and then be overlooked by another?

Penny Hawkins: No, I do not believe they would. I think there is a suitable framework in place to ensure co-ordination that I think will work.

The Chair: Can I thank Dr Hawkins for her time and for the evidence she has given to the Committee, which I am sure we will find very valuable? Thank you very much.

Penny Hawkins: Thank you for the opportunity.

Examination of Witnesses

Lawrence Woodward OBE and Pat Thomas gave evidence.

2.19 pm

The Chair: We have until 2.50 pm for this session, so please could you introduce yourselves very briefly and then we will move straight into questions?

Pat Thomas: Good afternoon, and thank you for having us here today. My name is Pat Thomas. I am the co-founder and co-director of Beyond GM. I come from a journalistic background. I am a former trustee of the Soil Association and the Organic Research Centre, and I currently sit on the board of the Nuffield Council on Bioethics' dialogues on genetically engineered animals.

Lawrence Woodward: I am Lawrence Woodward. I am co-director of Beyond GM; I am also a director of Whole Health Agriculture. I am an adviser to the Seed Sovereignty UK and Ireland programme. My previous life was as director of the Organic Research Centre, during which time I was involved in setting up an organic seed breeding company, developing a programme of evolutionary plant breeding. I was also a founder and director of the European Consortium for Organic Plant Breeding.

Q182 Jo Churchill: Good afternoon. We have heard from witnesses earlier today, and on Tuesday, that this technology is equivalent to traditional breeding—that is the term I will use, just for ease—and carries the same level of risk. I understand that you have a different point of view. I would like to understand what the evidence base for that view is, with specific reference to precision breeding and gene editing, in both plants and animals.

Lawrence Woodward: The first issue is clarity of definition and terminology, which indicates concerns and differences of view regarding areas of risk. We start with this terminology, "precision breeding", which is found nowhere else in any regulation of any other authority—it does not exist. It is a new term, and the definition of what that is, the description of what that is, only exists in this Bill and nowhere else, so there is a question about where safety issues and issues of regulation and risk assessment come in.

The Bill itself starts off with the premise that all these technologies arise from genetically modified organisms. The definitions in the Bill start off with GMOs as defined in the Genetically Modified Organisms (Deliberate Release) Regulations 2002. Those definitions have given rise over the years to contested science in relation to risk assessment and safety. The Bill goes on to say that any of those techniques under those GMO regulations can be considered to be precision breeding if they could have been achieved by traditional processes, but there is

no international clarity about what traditional breeding or traditional processes actually are. The narrative in the UK is, "This is traditional breeding", but different people mean different things by that. In fact, I noted that several speakers on Tuesday talked about conventional breeding, which is probably more accurate. When we talk about that definition of traditional breeding or conventional breeding in modern times, the methods are very different, and the contention is that the damage within the breeding process—the potential risks within the genome—varies according to the different methods.

The evidence presented by the Advisory Committee on Releases to the Environment and numerous scientific bodies in this country is that risk can be assessed adequately on the basis of the final product, on the phenotype: what it looks like, and how equivalent it is to something that comes from conventional or traditional breeding. That, it has to be said, is the opinion of most research establishments and plant breeders in the UK and in some other countries, but it is not true to say that it is an overwhelming consensus. There is a body of evidence that says, "Actually, there are other risks", and that looking at and assessing risk in relation to the end product misses disruption within the genome, and the potential health and safety aspects of that.

Disruption in the genome is at the heart of genome editing technologies, because you are going right into the cell—into the organism. I have to say, I think it is unfortunate that this Committee has not taken oral evidence from the number of scientists who work in medical practice and agriculture who have looked at the evidence of the risks of this damage within the genome and what that means, and can talk about it much better than me.

In our view, the extent of the damage and disruption within the genome is a contested area. The question then is: what does that mean for the composition of the final product, and what level of risk assessment is appropriate? That is another critical issue in this scientific debate. A number of witnesses on Tuesday referred to proportionate regulation and proportionate risk assessment. We absolutely agree with that, but it is a question of how you discuss proportionate risk assessment. Other regulatory authorities work on a system of tiered risk assessment and risk safety analysis, with different tiers for different levels of the application of this technology. We think that really should be looked at. To come back to your question, the evidence of safety and the evidence of risk is in our view entirely dependent on that tiered risk assessment.

Q183 Jo Churchill: Thank you. With sufficient risk assessment, and defined as conventional breeding, you are not opposed to this technology? Is that what I should take from that?

Lawrence Woodward: We are not opposed to the overall application of biotechnologies. Some aspects of genetic engineering technologies are very interesting, and there is certainly some amazing science happening. We are not opposed per se; it is about the context, the framework, the risk assessment and the wider social utility and environmental impact assessments.

Jo Churchill: I should just say that it was probably out of scope to call people who are much more based in the world of the human genome, but of course we know what advances have been made there using this technology.

Q184 Daniel Zeichner: Good afternoon and welcome. Can I take you back to your opening point about definitions? It is right at the start of the Bill, and we have already had some discussions. A lot of us are struggling, quite frankly, to make the link between what the Bill was promised to be about and what we think the definitions end up being about. The basic question on which I sought an answer from the Government's chief scientist this morning is: does the Bill as written exclude transgenic material?

Lawrence Woodward: No, the Bill is vague on definitions. Other regulatory authorities have been presented as basing their approach on end-product analysis and ignoring process, but that is not true. It is only Canada that only looks at the end process; all the other regulatory authorities look at the end product and the process. The scope of this Bill captures not just narrow gene editing, as presented by the famous word processing approach—"We alter a letter here and there and everything is okay". The scope of the Bill is very wide, and it appears to encompass the possibilities of all new developments in biotechnology, such as RNA information sprays. This encompasses a range of things that are on the cards in the future, yet the clarity of that definition and scope are lacking, as are the assessment and consultation processes to deal with those new technologies coming forward. We have the possibility here of enlarging the scope into the future, ill-defined and without the regulatory framework to deal with that expansion.

Q185 Daniel Zeichner: Thank you. Could I turn to Pat and perhaps explore the wider environmental impacts and the extent to which the Bill provides reassurance and protections?

Pat Thomas: In essence, the Bill does not provide any reassurance about environmental impacts, because the Bill has decided that there are no environmental impacts. You have heard statements from scientists, and I will underscore my colleague's point that it was a shame that dissenting scientists were not invited to present evidence to the Committee. The Bill itself has made a prejudgment that these technologies present no environmental risk, but it has not, as the Regulatory Policy Committee concluded, presented any evidence to prove that.

Particularly where we are talking about plants, which are the dominant lifeform on this planet, and a very wide scope of which are exempted in this Bill, we need to be very clear about what the environmental impact will be, not just in agricultural nature, but in wider nature. That requires much more comprehensive assessment than is currently being looked at. At the moment, the assessment is really whether it is good for business. That is fine—we all want to see business progress—but these kinds of disruptive technologies that cut across multiple areas of concern need to be assessed on a much broader basis.

One thing that would immeasurably improve the Bill would be to ensure that the assessment board is looking not just at something that is scientifically feasible, but at the impacts across environment and the social scale, from a practical, an ethical and even a vocational level. There are examples of that in the world: the Norwegians have an agricultural biotechnology board, for instance, which assesses genome edited products on all those bases. Science does not outweigh, for instance, ecological or social concerns.

A very interesting example of that was in 2017 when that board rejected a double-stacked maize that was engineered to produce its own insecticide and be resistant to herbicides. While it accepted that the maize was probably safe to eat or to grow, the deciding factor was that there was no social utility. There was no benefit for consumers or for the environment, and those concerns, given equal weight to science, were the concerns on which it was rejected. That is what we need here. We need a much broader consideration of the impacts of these technologies.

Q186 Daniel Zeichner: Following on from that, do you see anything in the Bill that limits the scope for herbicide-resistant edits in plants, or, for instance, pesticide-resistant bees, which I have been reading about? Those are both possibilities that raise some wider issues.

Pat Thomas: They certainly do raise wider issues. Within the scope of this Bill, as my colleague pointed out, there does not appear to be any type of genetic engineering that is truly exempted. If a plant or animal breeder can make a case—that case is not checked, it is simply made; it is a notification, not an assessment—that their plant is herbicide tolerant and that there somewhere exists a plant that is also herbicide tolerant, that plant becomes exempted under these provisions.

Lawrence Woodward: If I may just add to that, I had rather lazily gone along to some extent with the claim that gene editing technology will reduce the amount of herbicides and pesticides being used. I was therefore somewhat upset and surprised to see that Cibus, one of the major gene editing developers, put out its annual report the other day with a press release praising efforts around the world and in the UK to deregulate genome editing, because it saw the possibility of increasing herbicide-tolerant traits for sale, thereby increasing the use of herbicides in agriculture. It saw a way in which genome editing technology could increase the effectiveness of putting in herbicide-tolerant traits. That is an example of the complex nature of this area. The question of utility, sustainability, reduction of herbicides and so on, which people talk about, is really not a given.

Pat Thomas: I just want to add a brief point: within the scope of the Bill, the concept of risk is being used interchangeably with sustainability. Risk assessment and sustainability assessment are two entirely different things. A sustainability assessment will look more across the board at the sorts of effects that we are talking about here. We should not take for granted that risk or safety can be used as a proxy for sustainability.

Q187 Deidre Brock: May I return you, Ms Thomas, to the points that you were making about Norway? I think the Norwegians introduced a gene technologies Act fairly recently. When I read about the approach that they took to the issue, it seemed to involve a lot more public consultation and discussion. Will you expand a little on the approach they have taken to this issue? What can we learn from it? What would you like to see included in this Bill?

Pat Thomas: I think we can learn the value of citizen views. I have been a little disturbed, in the first session and this one, by the vague disdain for citizens—"Citizens must not understand the science, therefore they must not have a view." Citizens are major stakeholders in the food system.

What that board does is to have a high percentage of civil society groups in particular, who are used as a proxy for citizens, but it also seeks out citizen views. What we have learned from citizen engagement in our work and in sharing the work of others is that citizens tend to ask a much wider range of questions of the food system. When they are not asking those questions, it is because some aspect of the food system has been hidden from them. For example, until we understood about battery hens, people did not ask questions about that, but they ask them now. When people began to worry about pesticides in their food, they began to ask questions about organic food.

A concern for me about the Bill and citizen engagement is that the term "precision bred" is not well known. It is in fact a way of sneaking genetically engineered foods into the food system. I can envisage a case in which—even if there was a turnaround on labelling—to label something "precision bred", for example, is not useful information to people who do not understand what that term means.

To circle back to your question, the importance of including citizens in these kinds of assessments is that we get a much more well-rounded assessment, and something that takes into account questions such as, "Why are we doing this?", "Is there an alternative?" and, "If there is an alternative, why are we doing this?" Those questions are very important.

Lawrence Woodward: May I add to that? The Norwegian law is one thing. People always think, "Okay, it's in Scandinavia, they don't do much GM anyway," but I remind you that in 2015 the House of Commons Science and Technology Committee—of which I believe you were a member, Chair—recommended in its inquiry into agricultural technology the establishment of a permanent citizens panel to work alongside ACRE in assessing all these other aspects of gene technology, such as its application, its commercial roll-out and so on. That is embedded in the House of Commons proceedings. It did not get very far, obviously. The other point about that is that although that provision did not go into detail as to what would constitute a permanent citizens' panel, the Norwegian one does, in terms of balance of citizen representation and stakeholder representation.

Q188 Deidre Brock: We received a briefing from GeneWatch UK, in which it talked about its concerns about a potentially significant impact on trade. As you perhaps know, the Scottish Government are waiting for the EU to complete its consultation on gene editing and GM, and the difference between those two, and whether or not it may allow them to be permissible within Europe as well.

GeneWatch UK said that if exempt GMOs are not traceable—because they are considered to be, as we have heard from several witnesses, the same as conventionally bred organisms—manufacturers should be required to publish a validated test for each GMO released. It suggests that all countries that require such organisms to be regulated could potentially refuse all imports of food and other products that contain that exempt GMO. Could you just expand a little on that for us? I would be interested to hear your points of view.

Lawrence Woodward: If I have understood GeneWatch UK's position, it is pointing out one of the aspects of this situation, namely that if England proceeds by itself

—isolated, without regulatory alignment—that would raise all kinds of trade transparency marketing issues, which are not really addressed and which the Regulatory Policy Committee identified as not being really addressed in the impact statement. You then have dysfunction in regulation and alignment, which leads to confusion in the marketplace, and I think that GeneWatch UK was pointing out the fact that England might allow non-labelling and non-traceability of some of these products would not carry a weight in other markets.

There are many different ways of dealing with that situation. What is absolutely clear is that there needs to be in this Bill greater consideration of traceability throughout the supply chains so that the market can function, and both farmers and consumers have choice. There are different ways of doing that.

GeneWatch UK pointed to the need to develop specific analytical tests. Those analytical tests are being developed. Robin May at the Food Standards Agency pointed out—I think he made some comment that labelling is useless if it cannot be verified. In theory that is true but, first, analytical tests do exist, they are being developed and they can be developed faster. Secondly, we already have in a lot of areas geographical identification and source of origin identification—in egg marketing, whether they are free range eggs or barn eggs. We already have marketing verification based on provenance and audit trails. There is no reason why traceability cannot be built up on that, if the right kind of mandatory information is put in the Bill.

There is a separate discussion about labelling. Obviously, we are in favour of labelling. How that would be, where it is and so on—we recognise the difficulties.

Pat Thomas: To add to that, we have heard a lot over these sessions about how it is not possible to trace these organisms and that simply is not true, particularly for a patented organism. There must be something in place to trace that, in order to protect the patent. So, alongside the development of these organisms, there is also the development of the tests to trace them. The question is whether we will put those into effect or not. I would assume that if the developers want to protect their patents they would want to ensure that those tests are there and available.

Q189 Katherine Fletcher (South Ribble) (Con): There are a number of things that I think we have heard robust evidence on, but you have clearly spent a lot of time looking at this in a global context. Countries such as Canada, Japan and Argentina are forging forward and allowing their scientists to develop new lines and strains to move forward their agriculture. Do you have any comments on how they are doing it? In all candour, I am worried that, to prevent worries and questions such that you are raising, we almost throttle something that has the potential to be genuinely transformative. What assessment have you made of what Canada, Argentina and Japan, who are forging ahead, are doing?

Lawrence Woodward: People often forget in this conversation that European research establishments overall have made an awful lot of research investment into GMO technology and gene editing technology. Some great work is being done in UK research establishments. It is not that we have a block on this. On how much faster would deregulation, in terms of what is envisaged in the Bill, increase that research activity, others can speak more on that. It is not entirely clear to me that that is the case. It might be a benefit in terms of increasing inward investment from multinational companies.

Q190 Katherine Fletcher: I can believe that. It is already happening out there in the world, I just wondered what you thought about what was going on in Canada, Japan or Argentina?

Lawrence Woodward: The impact statement pointed to the development of research in Argentina by pointing to the increase in the number of patents that have been registered in Argentina since it altered its regulation. You might say that is a proxy for research and development activity. It is not necessarily. There is not really that much published information that says how much research is going on, who is funding it and where it is being funded. On the development of traits and the interesting science, it is not clear that it is any greater in Argentina or Japan than it is in Europe and the UK.

Q191 Katherine Fletcher: Sorry, what I meant was, obviously they have stuff in place and they have some sets of regulations in their countries to address your concerns, along with the laws that they have passed to allow gene edited, precision bred products. I wondered whether you have looked at what they have done to protect the safeguards while being able to forge ahead with scientific research.

Pat Thomas: In all those countries, the answer is that it depends. There is a patchwork of regulation throughout the world, with not much in the way of harmonisation. What is very clear is that the media narrative around these countries deregulating gene editing is exaggerated. In some countries such as Argentina there is a much more nuanced type of regulation that looks at things on a case-by-case basis. It is not a wholesale deregulation, which is what we are looking at here. That puts us out of step with those countries. China is the latest one to come on, again, with a much more nuanced approach to regulations. I think you have looked at the Canadian regulations, Lawrence.

Lawrence Woodward: The Canadian regulation is product-based but with a greater analysis of where the end product differs from conventional, so there is a trigger mechanism. I am probably still not understanding what you are asking. In the last five years we have had a lot of discussions with conventional researchers, GMO developers and so on. One of the telling things in our roundtable on the use of genome editing in animals was that the research and development very much depended on the commercial partnerships and roll-out. That very much depended on the markets that those companies could see. That depended on the type of agriculture that they were seeking.

It is not a surprise that most of the development is going into pig disease and those conditions that effect elite breeding lines, because that is where, for the breeding companies, the genetic ownership sees most return. That is not to say there will be no spill-over or benefit to small agroecological farmers and so on, but that is not the thrust. The thrust is about the commercial roll-out.

Pat Thomas: I think what you are asking is whether consumer concerns are being taken into account.

Katherine Fletcher: No, I was—

The Chair: Order. It is 2.50 pm. We have to finish there. I thank both our witnesses for their time and their full answers in this session. I am sure the Committee finds them very helpful.

Pat Thomas: Thank you.

Lawrence Woodward: Thank you for giving us the time.

Examination of Witnesses

Dr Michael Edenborough QC and Professor Sarah Hartley gave evidence.

2.50 pm

The Chair: We now move on to our next witnesses. Before we do, Professor David Rose of Cranfield University was due to give evidence on this panel, but unfortunately he has had to withdraw because he has covid. I welcome Dr Michael Edenborough QC, IP law specialist from Serle Court, and Professor Sarah Hartley from the University of Exeter. We will finish at 3.30 pm. Can you both very briefly introduce yourselves?

Professor Hartley: I have been studying genetic modification of biotech more generally for the past 20 years. I studied GM crops regulation back in the 2000s, and more recently have been looking at gene drive applications in the UK and more widely in Africa and North America.

Dr Edenborough: I originally was a scientist but I then became a lawyer. I am now a barrister specialising in intellectual property law, including such matters as patents, trade secrets, plant varieties and geographical indications.

The Chair: Thank you for joining us.

Q192 Jo Churchill: Thank you for your attendance this afternoon. A question to Dr Edenborough first: what impact has changing regulations on precision breeding had on the patents that are held in countries, with specific reference to small businesses? I am interested in how we can ensure a spread of the benefit of such techniques is felt across different organisations.

Dr Edenborough: The Bill itself does not purport to alter the intellectual property regime at all, so therefore this Bill will not have any effect on the underlying mechanisms whereby you can obtain protection—be that, for example, plant breeders' rights or a patent. Therefore, it will still be open to small and medium-sized enterprises to secure rights as they would have done. To that extent, this has no effect.

Q193 Jo Churchill: That is very useful and similar to the evidence that Mr Angus gave us earlier this week—indeed, it gives an open market. To Professor Hartley, your experience in this area is extensive, including understanding the global impact that this technology could have, or is having. Could this technology allow us to be a good global neighbour to those across the world who are struggling to feed themselves? That is more a food security point of view.

Professor Hartley: The Bill enables science to develop in this area, but it does not enable us to direct the science and technology towards doing any good. That would require a different form of governance. We know that gene editing and genetic modification are used in similar ways because we have not seen them separated out in any great detail yet globally. There have been some successes, but there have also been some failures—I would point to the GM cotton in Africa, particularly in Burkina Faso, where it failed to deliver the benefits and, in fact, had quite a negative impact. The question is whether the Bill can provide any public good; the answer is that it would make no difference to the public good. It may allow gene editing to develop, but whether or not it serves the public good would require a different level of governance.

Q194 Jo Churchill: The Bill and Melinda Gates Foundation sponsors work in this area—at the Roslin, I think. Given that degree of altruism in this area, what changes to the governance framework might assist in improving food security? Or is that best left to that philanthropic drive?

Professor Hartley: We could leave it to philanthropists, but the process of governance within the philanthropy organisations is quite closed and run by very few people, often within the United States of America. Social scientists working in this space have shown that we need more people from the area where the problem is based to be engaged and involved in the development of the technology. You would need stakeholders, farmers, conservationists and so on to be involved in the development of the technology early on.

Q195 Jo Churchill: Would you say it is the design of how the work progresses more than anything?

Professor Hartley: Indeed. That can happen as early as the funding agencies that fund the research all the way through the development and design process.

Q196 Daniel Zeichner: Good afternoon to both of you. Professor Hartley, in your previous answer, you said there was essentially nothing in this Bill to promote the public good. What would need to be in there to allow that to happen?

Professor Hartley: One of the challenges the Bill faces is that it does not address the results from the consultation that DEFRA held. Some important issues came up through that consultation—around transparency, traceability, labelling and engagement—that do not appear to be addressed at the moment. I also think the focus of the Bill on the consultation has been around agriculture, and yet applications in conservation and environmental management are also possible in the Bill. There are a range of stakeholders in those areas who have not been sufficiently engaged, I believe, in the development of the Bill.

Q197 Daniel Zeichner: You have done work before on public engagement. What would need to be changed to respect the outcomes of the public engagement that has gone on so far?

Professor Hartley: We have known for 20 years some of the issues that the public care about in the space of emerging biotechnology, and that includes labelling, which we know is key. We also know that the public have much more support for technologies that deliver public benefit and are not for profit. Over time, these issues are quite consistent across a lot of emerging technologies, but particularly in biotech.

We could argue that part of the failure of the GM crops was that they did not deliver the public benefit that they promised to start with. They promised to feed the world and contribute to global food security, but in fact the products that were developed ended up serving the farming industry and delivering higher economic profits. We also note it is not reflected in the Bill that animals are much more of a concern to the public than crops. Again, the sensitivities to those issues of concern do not appear to have been addressed in the Bill at this point.

Q198 Daniel Zeichner: Perhaps I could return to Dr Edenborough now. You may well have heard some of the discussions about the definitions at the start of the Bill, and there clearly are different views as to what they mean. As someone who might be called on to interpret the Bill, how confident are you that that will be straightforward?

Dr Edenborough: Well, I am confident that it would not be straightforward.

Q199 Daniel Zeichner: Could you elaborate?

Dr Edenborough: The simple point is that clause 1, as drafted, is quite imprecise. For example, if I may refer to the detail, there is the way in which subsection (2)(c) says,

"every feature of its genome could have resulted from…traditional processes…or…natural transformation."

First, "could have resulted from" is staggeringly imprecise. Is that "likely"? Is that "very possible"? What level of probability is it? Then "traditional processes" is actually defined further in subsection (7), but it is still incredibly wide. However, "natural transformation" is not defined, so that clearly gives scope for further debate.

Even more fundamentally, "modern biotechnology" is, in subsection (3), defined by reference to the Genetically Modified Organisms (Deliberate Release) Regulations 2002. That is wide. However, subsection (8) says that if those GMO regulations are modified, the knock-on effect, with respect to this Bill, is that the regulations may be modified

"to make corresponding changes (with or without variation)".

Again, that is incredibly wide.

I hesitate to raise it, but there is also, in essence, a Henry VIII clause tucked away in clause 42, which is incredibly widely drafted. Those clauses always give rise to concern because, basically, you can do what you like, when you like, with very little scrutiny. Does that sufficiently address my concerns?

Q200 Daniel Zeichner: Well, it highlights the concerns that we have. Going on from that, my next question is on the terms "precision bred organism" and—this is not in the Bill, but it is related to it—"qualifying higher plant". Will those terms be easy to define if a challenge comes as to what would constitute those categories? It is the same question that I asked before, really. From this legislation, would you be able to discern the answer if someone comes to you and says, "Is this or isn't this one of those categories?"?

Dr Edenborough: No, it would not be easy, for the simple reason that, because of the breadth of the way in which things have been defined—in a cascading way—you have uncertainty built on uncertainty. If a particular set of facts were presented to me and I was asked the simple question, "Is this within or without this particular Bill?" the answer would be simply, "Maybe." It will depend on a raft of expert evidence that addresses each and every one of those points of cascade.

As soon as you get to a crunch point, whereby you need expert evidence to say whether it is within or without one of the particular points, you introduce uncertainty. If you have several of those, you introduce more uncertainty. Therefore, it would be dependent on a mass of expert evidence to determine each and every one of those points.

Q201 Daniel Zeichner: In your earlier answer to the Minister, you—I think rightly—pointed out that this Bill does not add anything in terms of intellectual property rights. In the absence of the Bill providing certainty, how might the wider gene editing debate develop commercially, and will it further the interests of research and development in the UK?

Dr Edenborough: At the moment, there are no bars within the intellectual property regime to doing this sort of work. So the hesitation comes not from the IP regime but from commercial factors: in essence, whether or not you are going to make money at the end of it. The Bill, though, could introduce greater uncertainty into the commercial field, which would arise because of the unclear way in which "precision bred" is defined. That could lead to people, in some senses, exploiting that uncertainty. Now, there are a number of ways in which that could happen, but one is that you could have a big entity with a lot of muscle, and therefore a lot of money, which might want to push all the boundaries and cause confusion in the marketplace. That could have a dampening effect on other, smaller people who do not have the financial muscle to challenge the legal parameters.

Daniel Zeichner: That is a very sobering prospect. Thank you; that was helpful.

Q202 Deidre Brock: Thank you to both our witnesses for your evidence so far. I would like to hear your views on the United Kingdom Internal Market Act 2020 and the implications for the future. Scotland and Wales in particular have objected to these measures—until such time that we, in Scotland's case, have heard from the EU about its consultation on this.

Dr Edenborough: My views will be limited to the legal aspects. The simple consequence is that something may, for example, occur in England that may not be permissible in Scotland. But there is uncertainty with respect to whether, if you grow something in England, you could sell the product in Scotland. That is unclear. I think that is probably as far as I can go legally.

Q203 Deidre Brock: In terms of the implications of regulatory divergence from the EU—*[Interruption.]* Is that a tough one?

Dr Edenborough: I am just trying to make sure that I understand your question.

Deidre Brock: Okay. Obviously, the problem for Scotland is that we would like to stay aligned with EU regulations as far as is possible and practicable. What are the

[Deidre Brock]

implications for us and for exporting if the 2020 Act forces us away from alignment with EU regulations? I am thinking in particular about the impact on trade.

Dr Edenborough: There might be ramifications with respect to the rights that have been obtained. Actually, this slightly conflicts with an answer I gave earlier, because if one were to obtain a UK patent, that would extend not only through England and Wales but through to Scotland, so there are certain things that the Scottish people may be able to do, but there are other things that they may not because the Patents Act 1977 covers the whole of the four kingdoms.

With respect to the EU, there may be divergence in the way in which products from such precision bred organisms can be addressed. That may be controlled by plant varieties or by patents, but there might be other food regulations that kick in. The point is that certain paths will have to be unified—or are unified and cannot be changed. This Bill does not purport to change plant varieties or to change the patent law, so that is going to stay the same. But the ramifications of things that result from precision breeding may not be uniformly felt throughout the Union, because of other legislation.

Q204 Deidre Brock: People have contacted me about what happened with Monsanto, and I would be interested to hear your thoughts on the potential implications for that of anything in the Bill. I think Monsanto sued farmers because they retained seed from a crop, rather than buying seed again from Monsanto for the following year. Is there anything in the Bill that enables that? You are an expert on this subject and I would be interested to hear your thoughts.

Dr Edenborough: The Bill does not fundamentally affect patent law or plant breeders' rights, but the deregulation aspect will allow people potentially to secure patent rights or plant breeders' rights more readily in things that they would not otherwise have been able to secure rights in.

Let us say, for example, that you secure the rights to use—I hope this is a neutral example—a different type of mushroom. Once you have those rights, you can control various things: whether the mushrooms are grown and whether the products from the mushroom are sold. You might then say, "Well, I'm going to give those rights away free," but you may have engineered the mushroom in such a way that there are other things for which you can then charge—for example, particular types of pesticide.

This is a mechanism whereby you might be able to get rights more readily. I might say up front that the rights I have obtained more readily because of this Bill I am not going to charge for, but that gives me a foot into the market whereby I can charge a higher price for other things that are related to the protected items. If they were unprotected, you could not form that link, but because of the protection that you have secured through this deregulation, you can form that link and therefore get an economic advantage eventually—down the line.

Deidre Brock: Fascinating. Thank you very much.

Q205 Katherine Fletcher: We spoke in a previous evidence session about the difficulty of codifying the beautiful complexity of biology into law, because biology in and of itself is not in a static state. I think the quote was, "Biology is not physics; it's not a specific number." So I am sympathetic to some of the comments that you made earlier. What I want to chase with you is what the consequences of the uncertainty in the drafting are. I cannot understand why someone would want to say that something has been genetically edited when it has not been, and I cannot understand why someone would want to say that something has not been genetically edited when it has been—and that is an expensive process. You have much more experience, so what are the consequences of the uncertainty in the drafting?

Dr Edenborough: The long and the short of it is that a single entity can say different things to different people in different contexts and therefore, in essence, confuse and confound people. You can secure rights in a place by saying one thing and then perhaps avoid liability in another place by saying the opposite.

Q206 Katherine Fletcher: But there is no risk to humans, no risk to health. This is about a commercial give and take, in effect. That is the consequence of the uncertainty in the drafting.

Dr Edenborough: No, there might be risk. This is a circular definition, in some senses. You do not need to regulate these matters, because these things can result from a traditional process, or natural transformation. It is because of that that there is a low risk. But that is actually answering the question: you do not actually know whether the thing really could have been—

Q207 Katherine Fletcher: No, it is not—forgive me, Mr Stringer; shout if you want me to stop. The classic example is that Belgian Blue cattle, through a natural genetic mutation, ended up with double-muscle haunches. Everyone thought this was wonderful because you have a cow with a massive bum that is more saleable for the same food. But then there was the discovery of consequences about birthing and ease of birth, and it was dropped out. So I do not think saying, "It could have occurred naturally," and saying, "It is risk free," are the same thing.

Dr Edenborough: Perhaps we are talking at cross-purposes. The things that can occur in nature are not always risk free. So that agrees with what you have just said. But one of the underlying justifications, as far as I can ascertain, for this Bill and for removing onerous regulation, is that, because these things are supposed to be potentially capable of resulting from—"could have resulted from"—a natural process, it is likely that they would not be harmful, and that is a fallacy.

Q208 Katherine Fletcher: Biology can make mistakes—some mistakes are positive, and some are deleterious. But gene editing allows us to press fast-forward; it is a speeding up of the opportunity that natures engages in, but within an individual species. That is all true, but it is just happening faster, and with more opportunity and structure behind it, so we can go, "Actually, no, don't do that—it's a bad idea."

Dr Edenborough: It is not just a speeding up, in the sense that the way in which it would occur naturally is probably one step at a time. Here you are allowed to take many steps, so what might have been stopped at step 1, you suddenly get to step 5. Therefore, that could be a fundamentally different thing that you are releasing into nature.

Q209 Katherine Fletcher: That is not my understanding. What you are saying, in effect, is that what we do not want to be doing is creating a plant that is both drought-resistant and has a natural pesticide resistance, and—steps 3 and 4—tastes better and has vitamin D in it. You do not want to do all those in one go. I can see that argument, but surely the regulatory regime in the Bill will allow for people to say, "No, that is just a bit too complicated, when you have to go through the phenotypic analysis at the back of it." But I want to come back to the core point: what are the consequences of having to accept the biological uncertainty within the way we describe things? What bad is going to happen?

Dr Edenborough: I think it comes back to the point you just mentioned, which is that if you are doing one step at a time, the way in which the Bill will work is that you will probably be allowed to do that, but if many steps are taken, you may not be allowed to do that. The question is on the "may": who is going to act, in essence, as the gatekeeper on how many steps you are allowed to do at any one go?

Q210 Katherine Fletcher: I presume it would be somewhere between the market and the regulator, and we have heard about the importance of that. If you are going to go far down and take multiple steps, you are going to have to know that you are going to get a commercial return at the end of it, because this is not cheap or easy. So in the other instance you were mentioning earlier, I was thinking, "Okay, that could make it much more expensive to do, but then it is going to get disintermediated by something that is not as expensive." I hold to the view that law and biology are always going to do this and we have to make sure that we have got ourselves protected against any big negative consequences. That is why I keep pressing you on the "for instance".

Dr Edenborough: It falls back to the discretionary nature of the way in which the notification process and the control are exercised. If it is discretionary, it could be more or less active. That is the long and the short of it. You are going from a regime that is quite tightly controlled, and therefore every step is controlled, to one where you are allowed to jump through many hoops in one go, because the regulation allows for that in a discretionary sort of way. By having the discretion, you introduce greater uncertainty and therefore greater risk.

Q211 Katherine Fletcher: Okay, but if I flip it the other way and you do not have the discretion, you are effectively closing off avenues to what biology will do naturally. If you want to say, "No, we can only do this, this, this and this"—

Dr Edenborough: No, you are just closing off the pace at which you could do those things.

Katherine Fletcher: Right. I am very grateful for the exchange.

Q212 Kerry McCarthy: May I ask about liability? I hope this is within your remit. What happens if an organic farmer finds that there is contamination? Does the Bill provide any mechanisms or safeguards for people who might want to resist going down this path and are affected by it?

Dr Edenborough: Very minimal safeguards. I think you are talking about the potential release of an edited genome. What happens if it breaks out into the wild and then, for example, goes into the field next door?

Q213 Kerry McCarthy: Contamination was always the concern with GM.

Dr Edenborough: That could be a real mess. To prove it, you would have to have some sort of genetic marker, because you would have to prove causation, but then you would also have to prove damage and it might be difficult to do that.

Q214 Kerry McCarthy: But if your organic product has an organic trademark, in terms of the badging—there are rules about importing and exporting organic produce—that could potentially harm their ability to apply for organic certification.

Dr Edenborough: Yes.

Q215 Kerry McCarthy: But you are saying that it might be quite difficult to actually assess whether it had affected the product in that way.

Dr Edenborough: It ought to be relatively easy to prove causation, because there ought to be a genetic marker, but damage is nearly always the hurdle in negligence cases. If somebody says, "I've lost everything," the question is how much they have actually lost.

Q216 Kerry McCarthy: If you have a field of organic crops that could be contaminated, you would not necessarily know the extent to which the produce had been contaminated. The certification is based on what you have used on the field, how you have farmed and so on, so you would not know if something had affected it. Do you see what I am saying?

Dr Edenborough: Well, there would have to be evidence that there has been contamination, and that evidence would have to be predicated on a sample.

Q217 Kerry McCarthy: It might be quite difficult to quantify the extent to which—

Dr Edenborough: It is all worked on probabilities. You would not test every grain of rice; you would test a few thousand and extrapolate. That is the way that all damages cases work.

Q218 Kate Green (Stretford and Urmston) (Lab): I want to take this point about damage and liability a little further. You look alarmed, but actually I want you to simplify it a bit. The way you are describing it to me, I think the onus will really be on the person claiming that they have been damaged to make a claim and go to court. There may then be some difficulty for them. I think you are saying that there would be less difficulty in proving causation, because there would be a marker, but there would be considerable difficulty in proving the extent and the fact of the damage that had occurred. Is that correct?

Dr Edenborough: Yes, on both points.

Q219 Kate Green: What could offer better protection than this reliance on what looks, from the point of view of the organic farmer, to be a very unsafe means of obtaining redress?

Dr Edenborough: That is a fundamentally different point, in some senses, because if a person is alleging that they have been damaged, it is for the person making the allegation to prove their case.

Q220 Kate Green: I think what I am trying to say is that we are talking about a process of tort.

Dr Edenborough: Yes.

Kate Green: What might the alternatives be for offering protection, rather than going through the tort route?

Dr Edenborough: You could introduce some form of strict liability, whereby there is a presumption, in essence, against the person who is doing the contamination, but that is very rare. There are examples in patent law, but the exception is very narrow. The long and the short of it is that people do not like reversing the burden of proof. It does happen, but it is very rare.

Q221 Kate Green: This may not be a question for you; it might be one for Professor Hartley. Is there the potential for a real inequality of arms in this—that we are going to see, not invariably but typically, smaller organic producers against potentially global or large commercial entities in court?

Professor Hartley: One example of this arose in Canada in the early 2000s with GM wheat. I do not know whether this might illustrate the market concern about contamination. Europe had just banned GM foods, and the Canadian wheat market exported largely to Europe. Monsanto had an application with the Canadian regulatory system to develop and test GM wheat, and there was no way in that regulatory process to stop that application, and yet the wheat market in Canada was threatened. In the end, there was a careful behind-doors negotiation and Monsanto withdrew its application. There was the potential for Canadian farmers to take a significant economic hit if the GM wheat was developed there, and there was nothing within that regulatory system to stop it. I think that is maybe part of the concern you are raising here. The market, in that case, did decide, in the sense that Monsanto negotiated with the wheat board in Canada to try to solve the problem.

Kate Green: Thank you. Do you have anything to add, Dr Edenborough?

Dr Edenborough: You mentioned inequality of arms. The long and short of it is that, yes, the larger manufacturers will have much greater power than the small farmers.

Q222 Kate Green: Is there any way you would suggest to rebalance that inequality, other than the strict liability, which I think you felt was very difficult?

Dr Edenborough: The only way in which the small people can be protected is if there is greater regulation by the state, because the smaller people do not have the resources and they need to rely upon a third party, which in this case has to be the state.

Professor Hartley: Can I add a further point? We are talking a lot about farming here, but the Bill is not just about farming. It is also about conservation and environmental management. There is more structure to the farming community than there is to the conservation community, and so there is the potential for this kind of conflict within the conservation sector as well, particularly between the devolved nations.

The Chair: We have about 90 seconds, Daniel.

Q223 Daniel Zeichner: This will only take a second. I am trying to conclude this long and interesting discussion about liability. I think what you are saying is that in the end it will require something in law—in the Bill—to actually provide that protection. Is that correct?

Dr Edenborough: Yes.

The Chair: That was certainly under 90 seconds. I think that is a good place to finish. I thank both our witnesses for the time spent with us and their detailed answers.

Examination of Witness

Ed Barker gave evidence.

3.29 pm

The Chair: Welcome to the Committee. For the next session, we have until 3.50 pm. Would you please briefly introduce yourself by telling us your name and position?

Ed Barker: I am Ed Barker, head of policy at the Agricultural Industries Confederation. We represent agri-supply businesses in the UK, including animal feed companies, manufacturers, seed suppliers and distributors, fertiliser suppliers, arable marketing companies, grain traders and crop protection distributors. We also run a number of assurance schemes covering those individual commodities and products.

Q224 Jo Churchill: For the sake of transparency, I would like to put on record that I have known Ed for some years and many of his family are constituents of mine.

We have focused a great deal on food in our two days of conversations with witnesses. Can you expand a little more on what benefits there might be within the feed sector?

Ed Barker: We can certainly see potential benefits in the feed sector. There are a number of challenges across UK livestock sectors at the moment, and feed is a considerable way in which we can address issues such as reducing our reliance on imports, particularly of high-protein products such as soya from South America, and divert that to UK—in this case, England—sources. We also see huge benefits by way of having a greater number of crops available to UK growers. By doing that, we also provide a better feed market, particularly in crops such as oilseed rape, peas and beans, which often either provide direct feed or are made into feed by processing.

We can also see other potential benefits in feed additives and feed products as a way of reducing emissions. It was interesting that the food strategy announced a couple of weeks ago referred to this issue, and innovation technology is certainly a way in which we can look to address that. Looking far ahead, there is some really pioneering work looking at the digestibility of certain grasses that can be fed to monogastric sectors, such as pigs and poultry. There are some very interesting areas where we could really look to change a lot of the challenges that we know the supply chain has with regard to animal feed.

Q225 Jo Churchill: Some of those comments looked at the positive impacts that might be available through the use of this technology moving forward. Do you think the uptake across farmers and the wider supply chain—I think your membership covers the UK, so feel free to speak from a UK-wide perspective—would be large, and could you give me your views on labelling? Would it be possible to have a compulsory focus on labelling, and would that be an enhancement? What do you think about that?

Ed Barker: To take those one by one, certainly the opportunities are there, and the uptake opportunities would certainly come in. A question we often get asked

is: "How soon can the benefits be realised?" That is very difficult, particularly in combinable crops, which obviously have a much longer cycle of research and turnaround to be able to realise the benefits. From our point of view, however, the Bill's benefit is that it provides long-term flexibility—five, 15 or 20 years—for growers, farmers and agri-supply businesses around the UK. We know the world is moving on quite quickly. We have heard about Canada and Japan, and even the EU is not static on this issue. There is a huge amount of interest. If nothing else, we are preparing ourselves for the inevitable demands on innovation in the future.

For take-up from a farming point of view, one area that we really want to focus on, particularly in the trade, is what we call the fungibility of goods. If you take cereals, for example, a real benefit to growers at the moment is that there are multiple markets available to them. For feed wheat, there are markets in the animal feed sector. It can also be exported or go to biofuel sectors. Having that flexibility is a real benefit to a lot of growers, and it provides a lot of resilience in businesses.

A short-term challenge that we could see is that if a product were considered to be gene edited, of course, at the moment in the EU that would be considered GM. As a result, we would have to go through quite an extensive approvals process to export that product to the European Union. That is a big part of the fungibility and flexibility of the product, so in the short term, we are only really likely to see benefits if it goes into the UK or England as a market.

However, a potential opportunity would be to have within the Bill a parallel process in place whereby authorisations were made for approval in the European Union when a product is approved for release by the Secretary of State. That would make a big difference, because inevitably, no farmer or grower is going to grow a crop that has a very limited market available to it. The next witness will probably be able to talk about that in a lot more detail. That is a real difficulty, and in the trade, if you are trying to buy and sell these products and you have a very limited outlet market in place, you might actually find that the product has less of a market the more of it you have, and there may be a deficit. To take the example of assurance in the supply chain at the moment, if you have unassured wheat, it usually trades at a discount because the market available to it is less. I do not want that to stop the Bill from progressing, but it is a short-term to medium-term challenge that we have to recognise, given the EU's importance. In the past year, for example, we have exported about 1 million tonnes of cereal grains to the European Union, including the Republic of Ireland, so that flexibility is important.

Labelling has been mentioned. I think overall, labelling would be extremely difficult for the trade, because you need to label something right the way from start to finish. Let us take milling wheat as an example. You have to be able to define whatever the label is—gene edited or non-gene edited, GM or organic—and demonstrate that across the whole supply chain, and the compliance is quite strong. To do that, you have to segregate, and segregating throughout the supply chain is extremely challenging, very expensive and very difficult to do. The reason why it happens, for example, in the organic sector is that there is a market for it; the organic control bodies ensure that, but there is a market for it to ensure the additional costs of segregation are put in place.

With precision breeding—which, according to the Bill documents, can be bred by conventional means; it is just that it is quicker—the market would not see any great benefit from that. There has to be a pull factor for labelling, which would usually come as a result of added value, a health claim or a fortification, and the FSA and other bodies would already be asking for that evidence. If you are providing a claim on allergens or fortification with vitamins, the burden of compliance and providing that information will probably be much higher than anything that you do on precision breeding or gene editing labelling. The traders in the agri-supply business and throughout the supply chain would see no benefits whatsoever from labelling. In the trade, it would probably kill off a lot of the provisions in the Bill completely, because it just would not be economically viable to do.

Q226 Daniel Zeichner: You have probably answered some of my questions already, but I am going to explore some of those points further. If I understood you correctly, the risk is that if we end up moving a bit more quickly than our European partners but it is not clear that we are getting to the same point, it is quite likely that the industry as a whole will look at it and think, "This is too expensive and too risky, so we will wait." Is that your analysis?

Ed Barker: It would depend on the approval processes set out by the FSA, in this case. Breeders, companies, developers and the market would look at the process to go through for receiving authorisation as laid out in the Bill, whatever it might be for—an environmental benefit, lower inputs at the crop end, or a fortification or a food benefit at the other end—and if they feel that it is too laborious and too challenging, and too much evidence or time is required to do it, it is very unlikely that those technologies will move ahead, so the implementation of this is really important.

We see it, for example, in the UK for certain minor use crops such as linseed, where a number of businesses have had to seek authorisation for individual farm protection products because they are essential for that particular crop. The problem is that it is often unviable to make that authorisation because the crop in the UK is such a small size. That does not necessarily mean it will always be unviable—far from it. It depends entirely on the role of the FSA and the approval processes that are set in place.

It could well be that UK markets are available for precision bred goods, whatever they might be. We have mentioned animal feed, but other food items and even non-food and feed products could have a genuine market uptake. For example, a retailer may well want to seek to remove or lessen the amount of soy in monogastric diets, and may look to work with a plant breeder to develop a crop that has a high protein source. That could be carried right the way through to the retailer's end products. In those situations, I can see it as viable in the short term, but it depends on the type of products we are looking at and the type of markets we have in the UK.

Q227 Daniel Zeichner: So you are saying it depends on the FSA's approvals process. What would need to be in this Bill to give the levels of reassurance that you would be looking for?

Ed Barker: In looking at the Bill, the experience of Canadian authorities has been very intuitive to the process in place, because they take an outcomes-based approach. Another area that we are very interested in is the time taken to reach approval. It would be really positive if we were to have a set time-specific limit on authorisations within that. A big problem that we have at the moment with a number of approvals for plant protection products or GM feed imports from South America is that we have a very indeterminate approval process in terms of time. That has caused a lot of problems in the past eight or nine months, when the market has not known whether or not we should be making purchases of GM goods from South America. That uncertainty over time and time lags is a real challenge for the industry, and I think that would be the case. Some certainty over time or statutory requirements on approvals, even a requirement or expectation of turnaround, would be very helpful. At the moment, that is making a lot of difficulty for the trade on existing GM approvals.

Q228 Daniel Zeichner: One final question for the moment: to the lay observer, these flows backwards and forwards between different countries and within the UK are quite staggering. I may be pre-empting the next question, but, given the issues you have just talked about, how much will the different approaches taken in the different parts of the United Kingdom impact on your people?

Ed Barker: It is a concern of ours that we have a difference in approach across the constituent parts of the UK, or certainly within England, Wales and Scotland. That does not necessarily mean that we should stop within the context of this Bill. What we need to know as a trade is exactly what can and cannot happen within, say, Scotland or Wales. There is uncertainty on what a grower can do. I am sure growers or even livestock owners in Wales or Scotland would be interested to know where they stand on purchasing seed, if we presume there is precision bred seed in England.

My understanding of the United Kingdom Internal Market Act 2020, having read through the House of Commons Library interpretation and the accompanying notes in the Bill, suggests that, if a precision bred product is placed on the market in England, it can then be sold in Scotland or Wales—obviously not in Northern Ireland, of course—but if I was a grower, or even a maltster or a miller in the supply chain, in Scotland or Wales, my first question would be, "Where does that stand with regard to regulatory compliance?" There are clearly areas within this Bill and within scope of the 2020 Act that, to my reading, potentially come into conflict.

What seed can you use if you are in Scotland? Can you use precision bred seed bought from England, for example? Can you feed your animals on precision bred animal feed purchased in England? Similarly, we have very integrated pig and poultry sectors for genetics, breeding nucleus herds that move around the UK quite significantly.

For clarity, either way, understanding what obligations or requirements are on businesses and farmers in each of those territories is absolutely key, because any ambiguity would create the risk that the industry and supplied businesses would take a risk-averse approach and not undertake to put in place any of the precision bred products that we may have opportunities to use.

Q229 Deidre Brock: Ed, you seem to be suggesting that while the EU is retaining its approach to gene editing and GMO, the UK could negotiate on a product-by-product basis with the EU on any gene edited products it wished to export to the EU. Could you take us through that process? You say that FSA has to approve that. Would there be costs that could come about as a result?

Ed Barker: Yes. At this moment in time, if you are an exporter to the EU you make an application for approval of a GM product; these products are mostly feed and predominantly from north and south America. These go to the EU and the UK as applications for approval as GM. This is something that has happened for quite some time. Only very recently have the FSA in England and the FSS in Scotland approved seven or eight GM feed varieties that originated from north and south America, mostly maize and soy, I think. So that is the current situation we have.

Our understanding and reading is that, because the European Union currently considers gene editing to be equivalent to GM, if you were developing a really interesting new high-protein crop, such as rye or oilseed rape, and you wanted to try to export that to Northern Ireland, the Republic of Ireland or the rest of the EU, then it would be considered as GM, for which, as we know, there is a much higher bar for approval in the EU. It is difficult to determine the speed and the turnaround of approval of the application for that product for those markets. That is why it would be welcome, if and when the Bill progresses, for us to have a clearer position about what happens when a precision bred product is approved by the Secretary of State in England, so that the Department for Environment, Food and Rural Affairs and the Department for International Trade very quickly try to establish approval for it in the European Union as a GM product, because that is how the EU defines such products. We would not be able to export there without that approval, so having that followed up as quickly as possible would be very significant for the market.

Q230 Deidre Brock: Without labelling and really strong traceability, what do we do regarding cross-contamination? How do we prove to Europe, while Europe is adopting its current approach, that the product has not been contaminated—I know that is a loaded word, but you know what I mean—by gene edited products when there is no traceability in the scheme and no labelling?

Ed Barker: Is the question how does an EU importer know that what they are importing is complaint with EU legislation with regards to GM approvals?

Deidre Brock: Yes.

Ed Barker: The challenge that we often have, particularly with some GM products but also with gene editing, is that testing is very limited, which is a concern. For example, at the moment the prevention of imports of unauthorised GM varieties from south America to the EU is largely done on a chain of custody basis, because the liabilities involved for importing something that does not fall within the remit of the regulatory compliance within the EU is extremely high. The major importers are large, multinational companies that have an extremely high compliance burden placed on them, with the chain of custody and contracts supporting that.

Inspections take place and each company will have very clear audit trails regarding those supply chains, to keep reinforcing that, and that is what we would expect to happen in this case as well. I suppose you are potentially moving into what would happen if an individual company wanted to export a product knowingly. That would fall under existing regulations regarding fraud and claims based on export notifications.

The Chair: I'm afraid that brings us to the end of the session. Thank you for your time and evidence.

Examination of Witness

Paul Temple gave evidence.

3.50 pm

The Chair: Good afternoon, and welcome. We have until 4.10 pm for this session. I would be grateful if you could introduce yourself for the record with your name and position.

Paul Temple: My name is Paul Temple. I am a mixed farmer up in east Yorkshire. I have arable crops and beef suckler cattle, and I manage environmental stewardship ground. We also carry out conservation agricultural practice. I am a seed grower and have worked most of my life dealing with co-existence and integrity issues. I took part many years ago in the Government's field-scale evaluation trials.

I have been involved with EU farming organisations for many years, and I am currently a director of the Global Farmer Network. I have been fortunate to travel the world and understand what farmers are doing on all levels in virtually every continent. I am probably here because I am a participant in Science for Sustainable Agriculture. Genuinely, in the 40 years of my farming, I have never had a farming circumstance to contend with like we have at the moment.

The Chair: Thank you very much. We will move on to questions, starting with the Minister.

Q231 Jo Churchill: Good afternoon, Mr Temple. I wonder if I could ask you on a broad basis what you, as a member of the farming community and somebody with vast experience in farming and seed production, feel the likely uptake by farmers of precision bred products and technologies will be. What is your experience from other countries of PBOs? Could you speak a little about how you manage co-existence currently and whether you think the same regime will continue?

Paul Temple: That is quite a lot.

Jo Churchill: It is, but you can answer as much or as little as you like.

Paul Temple: I took part in the field-scale evaluation trials because I was sceptical, but I have always had an interest in science. I participated because it would expose me to field-scale working with these crops. I then realised my naivety about the amount of science and genetics behind breeding. I certainly learned, to my horror, how the quality of the scientists tended to be lumped against those protesting with a subjective view rather than an objective view. I learned then about appreciating the science behind genetics, but I would not have done unless I had participated.

A lot of farmers in the UK will not have been exposed to what I have, so they will not appreciate it. With farmers, you tend to find that if something works and is of benefit, they are pretty quick adopters. They tend to adopt it most when they have seen other farmers adopt it. I adopted conservation agricultural practice because I had seen that it did work. I am hoping that trials will happen as part of this to allow farmers to see it first hand in their own geographic region. Then they will make their own decisions. Usually if something works, they are pretty quick at picking something up.

Across the world, I think my frustration, especially being involved in Europe, is with Spanish farmers. I have seen GM maize grown in Spain, and they grow it because they had a problem. GM solved the problem, and they use a lot less water to produce more crop. It just made pure commercial sense, and that primarily is what drives it. It is usually a matter of making commercial sense. GM delivers benefits in terms of reduced inputs. It usually comes with significant environmental benefit, because you are reducing your pesticides load, and that tends to get mixed up. Again, from a UK perspective, because I have seen what happens in south and north America, I understand the scale of adoption and what it has delivered into the marketplace in meeting China's demand for maize and soya, which is unusual for most farmers.

On the co-existence element, we obviously had to closely monitor it when we were growing these crops. We did not change any practices, found no problems looking after the crops and found no problems subsequently with volunteers that might be left over. We continued with trials on those, and that was not an issue. Co-existence really is not much of a problem. In any country I have been to, that is not the issue. It is usually the access to it that is a limitation. It has always fascinated me that a lot of the small farmers in Africa and Asia are given access to technology in a way that you cannot appreciate, which delivers benefit to them. Have I missed anything out?

Jo Churchill: No, that was perfect. It was an interesting contrast between the field—literally—and to how this can help on a global basis, rather than from a more academic standpoint. It is an interesting juxtaposition to what we heard earlier. Thank you very much.

Q232 Daniel Zeichner: Good afternoon and welcome. I do not know how much of a chance you have had to look at the details of the Bill, but it proposes a notification system and a public register. How supportive of that approach are you, and what effect do you think they will have?

Paul Temple: Obviously, I am not an expert in these particular areas, but I do not think we have anything to hide, so public registers—registers of seed varieties and what we are growing—are really important. What you put in the public domain, to my mind, has to be measured by what benefit or what risk there actually is. I suppose my frustration with the field scale evaluation trials was that, by making everything public, it just highlighted those who wanted to protest, rather than actually look at the science. So I think is it really important that whatever element goes into this Bill is done from a science perspective and a risk-based perspective. I do not have any problem with being open as to what is

happening on my farm. I think it is really important, but there just has to be some kind of sensible balance, so that it does not drag things down to where you cannot do anything.

Q233 Daniel Zeichner: On labelling and transparency, you have probably seen the research from the Food Standards Agency showing that the public would like to know more about where their food comes from. I think that is a growing trend in general. What do you feel about the labelling issues?

Paul Temple: Labelling is really important, but what I would pass back to you for a start is that 30 million tonnes of GM material comes into Europe, and there has never been a requirement for labelling through to the feed process, and that is on modification. This is not modified, and I think that is really important; it is not modified. This could be achieved through conventional breeding, and as such I do not think it needs specific labels. Again, to my mind, you do it from a risk-based perspective. If there is not a risk, there is no need to actually label it as such.

Going back to the global aspect, we are in a global marketplace and what we do not want to do is put ourselves out of kilter with the rest of the world and create double standards or unnecessary work. It needs to be measured and there needs to be awareness, but I do not think it should be stoked by those who seek to feed on the fear factor.

Q234 Daniel Zeichner: You may or may not have heard the evidence from our previous witness from the Agricultural Industries Confederation, who expressed concern—pretty much using the language that you have just used—that we are out of kilter with other places, particularly Europe, and that that could have a dampening effect on these developments. Do you share that view?

Paul Temple: I very much share the view that if you are out of kilter, as a net importer, you risk causing yourself problems. Again, it is about following the science. I have been to America a number of times and I have sat with the USDA in Washington. Those guys have huge quantities of experience of managing a rapidly moving area of science. To my mind, they are the people with the most experience in this field. You should speak to them and ask them how they manage something that is actually being put out into fields now. You should go to the people with experience of managing it.

Q235 Deidre Brock: Mr Temple, you said that you do not want farmers to be out of kilter with the rest of the world, but as we have heard today, and as I have read—this is one of the Scottish Government's concerns—we may be out of kilter with Europe's approach to GM and gene edited foods. Does that concern you? Some of the farmers that you come into contact with must export their goods to Europe. We have heard that there is the possibility for products to get through on a product-by-product basis, but that sounds kind of costly and would take up a lot of time. Are you not concerned about that?

Paul Temple: I have always been concerned about the approach that Europe has taken. However, there seems to be a more conciliatory approach on the necessity of enabling the technology. We will see, but there does seem to be some element of progress. What I find really interesting is the gene edited wheat that has been put out in Argentina. It is in fields in New Zealand and Australia, and the US pretty much accepts it. That facilitates trade. When countries like Argentina, which are massive net exporters, are willing to adopt this technology and look at its safety, there is a huge amount we can learn from that.

Q236 Deidre Brock: Although we heard from earlier witnesses that places like Argentina seem to have rather more regulations in place than this Bill allows for. Does that not worry you a bit?

Paul Temple: I am worried about us immersing ourselves in introspection and not moving at pace, based on science. I say that because I have been watching crops grow using all sorts of breeding techniques for years, and I have stood watching from the sidelines. I am slightly terrified that, if we do not get on with this, I will remain watching it from the sidelines. I say that because I am probably more aware than most of how vulnerable our production actually is and how necessary it is to have access to the breeding techniques and research in this field. I hoped that one of the things that Brexit might allow is a swifter ability to look at the science behind this and give those involved in research and breeding the ability to get on with it, on a science-based approach. There is always a concern when you get out of kilter with other countries.

Q237 Deidre Brock: Do you think this approach will in any way make up for the impact of Brexit? Do you agree with the Government's thinking that it might make some headway, in terms of the big impact on farming and agriculture from Brexit?

Paul Temple: Put Brexit to one side. This science is just too important to be immersed in those kinds of things. I am faced with a huge rise in my cost of production. I am looking constantly to reduce pesticides and fertiliser and to give my crops the ability to cope with the extremes of weather. I have a six-course rotation, and at the end of that six-course rotation, yet again I will need something that responds to the requirement to produce more against the rising cost of production. I see this, from a science point of view, as really important. From a UK point of view, we should be able to respond a little quicker because we do not have the decision-marking chains that you have in Brussels. I have seen the process and I know how it slows things down. I simply hope that we are now capable of responding to the science more quickly.

The Chair: If there are no more questions, I thank you for your time and evidence and we will move on to our next witness.

Examination of Witness.

Ross Houston gave evidence.

4.6 pm

The Chair: Our next witness is Ross Houston. We have until 4.30 for this session. Can you hear us?

Ross Houston: Yes, loud and clear.

The Chair: Excellent. Would you introduce yourself for the record, please?

Ross Houston: I am Ross Houston, I am currently the director of innovation at Benchmark Genetics, which is an agriculture breeding company supplying genetically improved Atlantic salmon, whiteleg shrimp and Nile tilapia for various global markets. I am fairly recent to the role; in my previous role I spent 18 years as a researcher at the Roslin Institute as part of the University of Edinburgh.

Q238 Jo Churchill: Welcome, Professor Houston. Could you explain how you are using precision breeding in your work, and what the potential benefits might be for aquaculture in the UK—Scotland in particular—and across the world?

Ross Houston: What we are currently doing is running family-based breeding programmes for genetic improvement of several traits in Atlantic salmon, whiteleg shrimp and Nile tilapia. Those traits, of course, include growth, but we are also focused on improving the resistance of the animals to infectious diseases. Some examples in salmon are sea lice and some viral diseases. That is not precision breeding as I understand it but family-based selection using genomic tools. We are undertaking research and development in the use of CRISPR.

I am talking to you from Norway because I was attending a project meeting where there are two large consortia—one Norwegian funded, by the Norwegian seafood agency, and one funded by the BBSRC, primarily geared towards using CRISPR as a tool to achieve substantial and possibly complete genetic resistance to sea lice in Atlantic salmon. The reason we are excited by those projects is that sea lice are currently one of the most pressing environmental, cost and animal welfare concerns for the industry. In particular, I would say that some of the treatment measures that we are using and, indeed, are obliged to use, have several downsides that I think we could potentially avoid if we were to develop resistant salmon that did not require those treatments. In so doing, we are not only improving the animal welfare but reducing the impact on the environment and improving the economics of the industry.

Q239 Jo Churchill: I will ask one further quick question before others have their chance. You explained that you are using CRISPR technology and the broader technologies, hence why in the Bill the definition is slightly broader. Will you define how fast this field is moving and spend a moment discussing the Bill and whether you think that we have the balance right to allow research? Arguably, the Bill is about enabling; it is not about that further piece down the line. Do you think that we have got it about right in the Bill, and that regulatory environment domestically and internationally?

Ross Houston: The Bill is a welcome initiative. It has been really useful to have this debate and discussion, because we see that CRISPR or similar technologies can help us achieve traits that are of benefit to animal welfare and the environment faster than we could do with conventional breeding alone—substantially faster in some cases. That is why we are investing in it. That is why the research councils, Government and industry in general are investing in this technology.

This technology is developing fast, I agree. It is exciting to scientists involved in it. We are narrowly focused on using CRISPR to introduce changes that could potentially have occurred naturally, so I think that is a welcome part of the Bill, that we are mentioning that those changes could occur naturally, via natural mutation. We are adding to the genetic variation that we have in our toolbox to select for. The way I see it is that CRISPR would ideally be a tool in the toolbox alongside the technologies that we use currently to develop improved strains of salmon and other species for production.

I think that a register of precision breeding would be a reasonable measure. I would be worried about going too far in trying to identify whether any particular product contained any particular edit, for example. That might be disproportionately difficult and complex, and to my mind without any real scientific basis. I do see that, if you were changing the genetic makeup of a plant or animal to have some potentially different human health benefit, such as removing allergens or something like that, there might be a rationale for labelling that particular edit. In this case, however, I think that the register is reasonable, but that the practicalities of tracing through particular edits would make that very unattractive to implement in practice, because of the logistical impracticality of doing so.

Jo Churchill: That is excellent. Thank you.

Q240 Daniel Zeichner: Thank you for joining us this afternoon, Mr Houston. Aquaculture is slightly different—I assume you are talking about the farmed sector—as there is always the issue of escape and the impact that could have on the wider environment in our seas and oceans. How do we protect against that? Given the measures in the Bill, how do we check, or what is the authority that would be overseeing, to see whether there had been any impacts as a consequence?

Ross Houston: Obviously, there are measures to try to stop escapees, but they happen from salmon farms. I think that CRISPR precision breeding technologies are a very promising route, and indeed the subject of much R&D, to ensure that the production animals are sterilised so there would not be any genetic introgression with wild strains. The way we are thinking about it, at least, is that we would be looking to farm sterile Atlantic salmon in the future. That is a desirable thing to do anyway, but in particular if we were to introduce gene editing in the future.

The other part to it would be, I suppose, the impact of issues such as sea lice, which I mentioned before, which could also impact on wild salmon. But, there again, that is within our toolbox, and the R&D is heading in this direction. That is what we would want to use the technology for: to try to tackle these problems in a sustainable, environmentally friendly and animal welfare-friendly way. So I see that these technologies have significant promise for reducing any potential impacts on wild Atlantic salmon.

Q241 Daniel Zeichner: I can see the potential benefits, but I am slightly worried about the potential risk in the wider natural world, and I do not see anything in the Bill as it stands to either monitor that or check that, or to provide sufficient safeguards. Can you reassure me?

Ross Houston: Could you repeat the question, please?

Daniel Zeichner: Basically, I can absolutely see the benefits, but I can also see risks, and it is the risk side that I am worried about. What I am asking you is

[Daniel Zeichner]

whether you can see anything in the Bill—I cannot—that provides a structure for monitoring and mitigating those risks.

Ross Houston: I see the risks as very small, but I do not think that I am in aposition to comment on the detail.

Q242 Daniel Zeichner: That is fine. I am certainly not laying it on you; it is down to us to come up with the answer to that one.

Ross Houston: Yes, but my practical point would be—this is the way we think about it—that we are aiming to ensure that there would be sterility of the farmed strains, and at least awareness of that potential risk of genetic introgression with wild strains, and essentially to eliminate that.

Q243 Deidre Brock: You will be aware, of course, that the Scottish Government want to wait until the EU's consultation on gene edited products is complete, because they wish to retain regulatory alignment with the EU and there are concerns about the export of salmon, which is a huge sector for Scotland—and for the UK, for that matter—to Europe, and to France in particular. Given that you are in the sector and close to it, can you tell us about your concerns about that potential impact? If the EU retains its current opposition to gene editing, what would be the impact on UK products trying to get into the EU?

Ross Houston: As I said, it is welcome that we are having this discussion, but of course most of the aquaculture in the UK is salmon farming, and most salmon farming occurs in Scotland. So from our point of view it is disappointing that we are not having similar science-based and open debates about the risks and benefits of these approaches in Scotland. The Scottish Government are also, via the Sustainable Aquaculture Innovation Centre, funding research that is looking to use CRISPR precision breeding technologies to tackle some of the sustainability concerns of the industry, such as resistance to sea lice and viral disease. Therefore, I think it would be welcome if we could have a similar discussion in Scotland.

Q244 Deidre Brock: Would you accept that, given the importance of Europe to the salmon export trade, it makes sense to wait to see what Europe is doing? I believe there will be some sort of response by next year. I am worried about the impact that moving ahead of Europe will have on salmon in particular.

Ross Houston: There is maybe a double-edged sword there. The trade is not only with the EU, it is also with other countries. We are an international company; we have operations in Iceland and Chile, and we are selling our genetically improved salmon eggs to a very large number of countries. My concern would be that if we do not start having that discussion with some urgency, including in Scotland, then, bearing in mind that Scotland and the UK are at the forefront of R&D in this field, we might fall behind in the innovation landscape. The benefits of that R&D and innovation might impact on elsewhere in the world, while we are taking that cautious approach.

Q245 Kerry McCarthy: I was reading earlier this week about how in Japan they have been using CRISPR to change Japanese sea bream. I think the technicality is that you end up with bream that have 20% more meat, because it knocks out a protein that means muscle growth is supressed. Basically, there is less muscle in the fish and presumably more fatty meat—if that is what you call it on a fish. You mentioned the impact on human health earlier, and you mentioned allergies—that was with CRISPR rather than with gene editing—but to what extent do you see us getting to a situation where the finished product, the fish, is so changed that it is nutritionally a different product? To what extent do you think we would need labelling for that? Allergies are one thing, but I wondered about it from a nutritional point of view. People are often told to eat fish. Should it be marketed as something that is different?

Ross Houston: Good question. I was using CRISPR and gene editing as synonymous—it is a gene edited product in Japan with the red sea bream. Those early examples are interesting, because they are markers that show that the regulatory environment is changing in countries such as Japan and some of the Americas. From our point of view, what we are doing here is running very advanced scientifically based breeding programmes. We are keeping 300 families of Atlantic salmon. With them we are pedigree recording, recording the genotype in each year, and recording lots of measurements relating to growth, disease resistance and fillet quality. We are doing that routinely, all the time. We are monitoring the important traits of our fish.

The R&D we are involved in is targeting gene editing to tackle issues such as resistance to sea lice in the salmon, resistance to a viral disease called infectious salmon anemia, resistance to a viral disease called infectious pancreatic necrosis—those are the targets of our research and development. In the foreseeable future—I could also go further than that—I do not see that we would be doing something similar to what you suggest in our breeding programme. We are able to improve growth and fillet characteristics through the process of routine measurement, family selection and scientifically based breeding programmes. It is quite straightforward to do it that way, and therefore it just would not be a sensible target for the technology in our case. We also see the public acceptance and customer preferences. The use of precision breeding technology to develop traits that have concurrent animal welfare, environment and economic benefits has to be what we are moving towards.

This sort of edit, where you are knocking out a myostatin gene and allowing for faster fillet growth, just is not on our radar. On the specific point about changing fillet characteristics, if you were perhaps trying to use gene editing to modify, for example, the fatty acid profile of the fish, with potential health effects for humans—hopefully it would target positive health effects—there might be an argument for it there. But I do not see the need with the sort of traits we are focused on and targeting; I do not see that the product would be any different, other than having the favourable trait of disease resistance, for example.

The Chair: I want to try to get two questions in, very quickly.

Q246 Katherine Fletcher: I will be very brief. There were tanks of fish when I was at university and I have seen the distress that sea lice cause to salmon. It is a problem that has been impenetrable to science, so I can see why that is exciting. My question, as someone who

is going to practically implement this, is not necessarily about the technique for inserting the change, but about the thing that is concerning most people. How are we absolutely certain that we have made a very specific change and we have not missed a bit or left a bit of rogue DNA in the wrong place? Can you briefly talk about what you would do within Benchmark Genetics to ensure that, in the nicest possible way, you were getting what you had paid for?

Ross Houston: I see what you mean. Of course CRISPR, the technique we are focusing on, is making a double-stranded cut to the genome and allowing the cells' natural repair mechanisms to repair the cut and either introduce a small deletion or a small change, or possibly insert a synthetic template of DNA, which would essentially be changing the sequence in a slightly more precise way. There are a couple of parts to that.

In terms of the potential for the CRISPR molecule to make cuts elsewhere in the genome—called off-target effects—we would have to be doing some fairly rigorous DNA sequencing of our animals to ensure that we are not detecting any of those off-target effects. My opinion is that we are now getting very good data from research experiments showing that off-target effects are very rare, and as we learn more about the genomes of our species we are able to design the guide RNAs to take to a specific part of the region that is unique and precise. I see that as a very small risk, but also one that it is important to address.

Q247 Jo Churchill: Did I catch you saying that the Scottish Government are funding precision breeding work within your institute?

Ross Houston: Yes. I moved job recently; I was working for a number of years at the Roslin Institute doing academic research together with industry. The Scottish Government centre, the Sustainable Aquaculture Innovation Centre, is funding projects using precision breeding technologies as a research tool with the goal of—

Q248 Jo Churchill: Brilliant. The "yes" was all I needed. Could you please expand? Professor Whitelaw, whom you must know very well, basically said that the value of moving now was that it enables us to enjoy the benefit of the R&D. You said we would fall behind. How would this affect our ability to potentially attract world-leading scientists from all over the world, some of whom I met at Roslin, to come and work with us on finding some of these solutions? Would it be detrimental if we did not move ahead?

The Chair: A very quick response.

Ross Houston: Yes, of course. As I mentioned earlier, the Scottish and UK science base is really at the forefront of some of these technologies, moving through from genetics, traditional breeding, family-based selection, genomics and now gene editing. That is a real plus point for attracting researchers. If we were to stop unnecessarily, both in research and potential applications, then it is a fair assumption that we would lose talent to elsewhere, and I think we would also lose business to elsewhere.

The Chair: Thank you. We will have to finish there, as we are out of time. May I thank you very much for your time and answers? We will now move on to the last panel, if they can join us at the table.

Examination of Witnesses

Professor Wendy Harwood, Professor Cathie Martin MBE FRS, Nigel Moore and Professor Mario Caccamo gave evidence.

4.31 pm

Q249 The Chair: Thank you and welcome to the Committee. May I ask you to introduce yourselves and your position, very briefly, please?

Professor Harwood: Hello. I am Wendy Harwood. I am responsible for the group that focuses on crop transformation and genome editing at the John Innes Centre on the Norwich Research Park. I am also a member of the Food Standards Agency's advisory committee on novel foods and processes.

Professor Martin: I am Professor Cathie Martin and I am also at the John Innes Centre in Norwich. I am also a professor at the University of East Anglia. I am a group leader responsible for focusing on the nutritional improvement of foods that we eat, and I have experience in trying to do that with GMOs and getting them through regulatory approval in the US. More recently, I have been involved in doing genome editing to improve vitamin content in tomatoes—my favourite fruit.

I should also say that the John Innes Centre is a member of the European Technology Platform "Plants for the Future". Paradoxically, I am chair of the working group on new breeding technologies, which is a collective of academics, industry, breeders and farmers in Europe looking to lobby for changing the regulations in Europe.

Nigel Moore: My name is Nigel Moore and I am the head of business development and strategy for KWS Cereals. KWS is a German-headquartered mid-sized company and we have a significant breeding activity here in the UK.

I have worked in plant breeding and seeds for more than 30 years now. I am a past chairman of the British Society of Plant Breeders and a past president of Euroseeds, the European seed association, where I am also discussing this topic regularly with Commission representatives.

Professor Caccamo: Good afternoon. I am Mario Caccamo and I am the chief executive officer of the National Institute of Agricultural Botany, or NIAB, which is a research and technology organisation based in Cambridge. We have more than 13 sites across the UK. We are an independent organisation, and we deliver field trials on those sites. We also have expertise within NIAB in genome editing and GMOs. Also, we work with breeders and we do breeding ourselves.

The Chair: Thank you. We will finish this session at 5.10 pm. I will move straight to questions, but I ask our witnesses not to say if they agree with somebody; that just takes time. If there is a different point of view, we are interested in that.

Q250 Jo Churchill: Good afternoon everybody and thank you for taking the time to join us. I will start with Mario. I know that NIAB works with a range of partners across industry and academia. What effect do you think the Bill would have on research and the plant breeding industry? Where would you look to improve the Bill? What challenges or areas would you like to bring up?

Professor Caccamo: I think there are two components to the question. First, the benefit is clearly in incentivising investment in human capital. There is a lot of expertise

in the UK—we are global leaders. Investment has come from the public sector. Taxpayer money has been put in place to develop skills, and seeing those skills put into practice would be fantastic. I see that as the biggest benefit. I will leave that there because my colleagues here will probably bring in other points.

On concerns and improving the Bill, I think the Bill is very balanced in terms of the definitions. There is a space left open for how much downstream regulation might be required, which I think is probably unnecessary and not proportional to what we might want to achieve with the Bill. The principle behind the Bill is that we would like to consider genome edited crops in the same way as any other crop that has been bred using traditional technologies. With that in mind, we should look into anything that comes downstream in terms of how we use outputs from these technologies in a proportional way. There is probably space there to be less specific and include so much detail, which could potentially be a deterrent for industry if it seen as adding unnecessary steps downstream. That is my main concern.

Q251 Jo Churchill: Thank you. That is helpful. Moving to Nigel, do you think the legislation allows for enough transparency from breeders? Could you talk a little bit about the current seed system and whether we need to enhance the regulatory framework?

Nigel Moore: Transparency is really important. As plant breeders, we do not have anything to hide. One thing that is often overlooked is that within the current regulatory regime around plant rights and seeds, there is already inherently a lot of transparency and traceability in terms of registering new varieties on national catalogues in the public domain, which will have had an identity check and at least two years of performance checking through DUS and VCU, which test for distinctiveness, uniformity and stability, and value for cultivation. The seeds of those varieties are then sold as certified seed with clear labels, with the variety name, batches, qualities, plant health status and operator identity all held within the seed certification regulation. We believe that allows a lot of traceability, so the transparency that is envisaged in the Bill of adding breeding method and genome edited varieties to the national register enables the market to segregate as it wishes.

Varieties will be suitable for markets or not. They can very easily select which varieties to enable within a standard, such as an organic standard. The one with the organic standard can say, "No, I don't want to use variety A, B or C because it is genome edited", and that is on the public register as envisaged in part 2 of the Bill.

Q252 Jo Churchill: Thank you. Moving to Professor Martin, in your current work researching the bio-fortified tomato—which, as you said, is your fruit of choice—what are the benefits of using gene editing techniques?

Professor Martin: Really, getting something that might translate into a product. I am a fundamental research scientist. I want to do things that have social utility, and I believe very strongly in improving the number of plants in our diet because that benefits health. I started off trying to do this by genetic modification and we made purple tomatoes with their GMOs. Fourteen years later, I am about to get them approved for commercialisation in the USA. It has taken me 14 years to get to that point. For the pro-vitamin D tomatoes, because they qualify as having no foreign DNA in them, that means I can even start within 20 days of notifying DEFRA under the new legislation. I can have a field trial of them. I could not possibly have a field trial of the purple tomatoes, so for me, it is the realisation that this could actually be something we could give to people that would be better for them. It might actually happen.

Q253 Jo Churchill: I can almost feel your excitement. Thank you. To Professor Harwood, as a member of the advisory committee on novel foods and processes, which I think you said was your other hat, what are your thoughts on food safety in regard to the use of precision bred technologies? It is obviously of paramount concern to not only those in this room, but the broader population, as we have heard.

Professor Harwood: I will just say that I am here in a personal capacity, not as a representative of the committee. Obviously, food safety is extremely important, and a lot of the things that the technology can do—we have heard many examples—are almost identical to things that could have been done using other methods, for example, through mutation breeding.

However, there are some things that the technology could do, and Cathie's tomato is one example, and there are others, of where a change would be made. It would still be just a tiny change in the DNA—something that could have happened naturally, but has not happened naturally so far—but it is making a change that might cause concern for certain people in the population.

Another example might be something like a low-gluten wheat. You can imagine that this would be something that would need a bit of extra scrutiny. There might be a food safety issue there, so it would need to be looked at. It is very much looking at things on a case-by-case basis. You would need to pick out those things that would need that extra level of scrutiny and risk assessment from those that probably need very light-touch regulation.

Jo Churchill: Okay, so more of a two-tier approach.

Professor Harwood: Yes.

Jo Churchill: Thank you.

Q254 Daniel Zeichner: Welcome to all of you, particularly the representative from NIAB. I have three quick questions, if we could rattle through them with each of you.

First, you will all recall the public confidence issues from 20 or 30 years ago, and that is one of the challenges now. I would like to hear whether you think the Bill has enough in it to reassure the public around some of those issues. Secondly, and in some ways related to that, most of you are plant focused, but this Bill obviously introduces animals, which is a very different set of issues and is, in some ways, perhaps more challenging. Do you think they should have been separated out? Thirdly, what do you think the public register will be used for and what benefit does it bring?

Finally, specifically for Cathie and Wendy, I had a constituent contact me, who has an issue around vitamin D being added to tomatoes. How will that constituent know whether these tomatoes have been modified in that way in future? It touches on Professor Harwood's final point, and goes back to my initial point, on the question of labelling and reassurance. Where should that balance be struck?

Professor Harwood: Shall I take the last question first? We have talked a lot about labelling. If there was something like a high vitamin D tomato, there would be a nutritional difference, which I imagine would be picked up on labelling. That would make sense.

Professor Martin: You would probably want to advertise it.

Professor Harwood: You probably would, yes. Where there is something that might be appropriate for certain members of public and not others, clearly you would want some sort of labelling.

Q255 Daniel Zeichner: But that is not in the Bill as it stands, is it?

Professor Harwood: It is not, but I think that would probably fall under part 3, which looks at food safety. I imagine that it would be—not being an expert—covered there.

Professor Martin: I want to expand a little bit on what Wendy said. What the Bill does is allow you to move forward with presenting examples. I have a real problem with trying to do a risk assessment on a technology and I know that lots of other people have said it should be on the trait, not the technology. It is a bit like 3D printing. Do we stop doing 3D printing or allowing people to do it because somebody could make a gun out of it? Or do we say, "We can make joints"? Okay, you can make joints by traditional methods, but you can do it much faster and better by 3D printing. Why do we not allow the technology and regulate the trait?

I absolutely agree about the pro-vitamin D enriched tomato that has never been considered before. There we have the regulatory system already in place from the FSA to consider it as a novel food. For environmental concerns, you take the specific edit that has happened and ACRE will assess. That is also why we want to do field trials. No person that is trying to produce improved varieties wants to produce something that is defective—it is just not in our DNA.

Daniel Zeichner: Not in yours, but possibly in others who are less public spirited.

Nigel Moore: I think the critical answer to the question is that public confidence and reassurance is at the heart of the Bill, in the definition of a precision bred organism as something that could occur in nature or by traditional breeding. There are many genome editing methods that can create additional changes. Absolutely the key step to generating public confidence and reassurance is the recognition that the techniques that can create those sorts of changes do not create additional risk. The ACRE guidance on qualifying higher plants that accompanies the Genetically Modified Organisms (Deliberate Release) (Amendment) (England) Regulations 2002 gave an extremely good evidence-based approach to which types of techniques create changes that could occur in nature.

The question is about an imprecise definition. We need the additional information to say, "These are the techniques that we confirm as PBOs—they are fine." Public reassurance is at the heart of this and we must make sure that we only put into this regulatory regime things that have the same risk profile as traditional breeding. What is clear from listening to the discussion today is how little information is known about what sorts of genetic changes happen in conventional breeding, or about the scale of those genetic changes.

I brought with me the AHDB recommended list. I will not go into it, but if we were to look at it, we would see that there are 38 varieties of wheat on the recommended list for the UK. They have many different characteristics, including resistances, yields, qualities for processing and vastly different protein contents—there is a range of about 30% of different protein contents. You can see null-lox barleys that have a different framing characteristic in beer making. You can see non-GN barleys that do not create carcinogens in whisky distilling. There are many food-safety single issues all in this vast range of genetic resources that have been created by traditional breeding. There is a wide range.

People should have confidence that all the food and all the breeding has delivered not risk, but improvement, safety and better environmental outcomes compared with old varieties. There is a big misunderstanding about the position of precision breeding. The public confidence question is about information, education and transparency. For me, that is at the heart of what we are doing here.

Public confidence should also be triggered by a recent study on the socioeconomic impact of plant breeding, run by HFFA Research, and which studied all of Europe. It showed that over the last 20 years in the UK alone, breeding development has saved 1.8 million hectares from agriculture and delivered about 16 million tonnes fewer CO_2 emissions than the same production at the same level 20 years ago. That is with no more fertiliser, no more crop protection and no more land use, so there is a huge benefit to the public. Can we keep pace with climate change, and with pathogen development on stripe rusts in wheat and so on, without going faster? We must go faster. Without new technology and innovation, I do not feel very safe. The world gets warmer, we get hungrier and we need innovation—and we need to do it fast.

Professor Caccamo: I will be very brief. Labelling the technology would be a mistake. It would undermine the principle of the Bill, because these technologies should be indistinguishable from traditional breeding or something that would happen in nature. But it is also important to stress that these technologies are actually more precise, as the Bill says. Therefore, we are in a position whereby we can advance genetic benefits much faster. Trying to identify the technology through a labelling system would probably achieve the opposite with the public, because it would probably raise concerns about why we need to do that. I will leave it there.

Q256 Deidre Brock: I absolutely agree with you, Mr Moore. Public confidence and transparency around all of this is vital, but we have heard criticisms today that the category of "precision bred organisms" is not recognised anywhere else in the world and is not based on scientific criteria, which could potentially present problems for trade in these goods. Do you know where the term "precision bred" came from?

Nigel Moore: I think we have developed it here, but the concept of things that could occur in nature or traditional breeding is exactly the same concept that is being discussed with the Commission. Health Canada

has also come up with a similar concept. Does it have the same three-letter acronym? No, but that concept is the common concept.

Professor Caccamo: I believe we are dealing with an anomaly, because what we are doing here is removing genome edited crops from the definition of genetically modified organisms. Countries that have adopted the technology have done a proactive measurement from scratch, whereby they considered genome editing to be a new technology that could bring new crops. The European ruling brought us into a position whereby we need to make an exception. That is the result we see in the Bill, which I consider, as I said, an anomaly.

Q257 Deidre Brock: Okay. I want to ask about clauses 6 to 9, which explain that applications for precision bred confirmation will be made to the Secretary of State by giving a marketing notice, and that he will then refer them to the advisory committee. For what seems to a layperson to be a fairly complex arrangement, it is rather lacking in detail. Do you feel confident that there will be sufficient protections in place, such as monitoring of persons who wish to apply for those confirmations? Do you have any concerns about that? Do you think that is an area that could be strengthened somewhat?

Professor Harwood: I can have a go with that one. To be honest, this is obviously an area that is still being discussed. I fully support the notification system and the transparency, which is absolutely the right thing to do. Exactly what will be required in the notification is still being discussed, and it is very important that it captures the crucial information that would be needed to highlight whether there was anything that might just mean that that particular example needed an extra risk assessment rather than a light touch. It is something that I think is being discussed, and perhaps it just needs a little bit of extra detail.

Q258 Deidre Brock: Would you like to see further detail in the Bill?

Professor Harwood: To be honest, I am not an expert on that. I would not like to comment on whether that sort of detail belongs in the Bill.

Q259 Deidre Brock: Okay. We have heard some criticism that there is not sufficient detail on the make-up of the advisory committee, for example, and concerns about not knowing who and what might be discussed on the board or the committee.

Professor Martin: I have a little bit of experience of the notification for being able to do a field trial. The notification was very easy. I talked to my Italian collaborators and asked, "Can you get regulatory approval for growing plants outside in Italy?" and they said, "It will take two years." It took me two days to notify DEFRA and I had to wait 20 days for that to be approved. However, it was thorough. They asked me about the type of information I had presented in a scientific paper and had peer-reviewed. It was based on strong scientific evidence. I felt that it was absolutely fair and just. It was fantastic that it was so quick, but it was absolutely right that they asked, "Have you shown that there is no foreign DNA?", for example. That is the definition of the qualified—

Q260 Deidre Brock: So, 22 days from your application going in—to DEFRA officials, not Ministers?

Professor Martin: You have to wait 20 days before you can start growing the plants outside after you have had your notification approved.

Deidre Brock: Oh, right, okay. I see.

Q261 Kate Green: Just a follow-up to that: why can't you do it for 20 days? What is happening during those 20 days?

Professor Martin: It gives them a bit of time to look at your form.

Q262 Kate Green: I thought you said it had been approved, and then there were 20 days?

Professor Martin: Let me just get this right. If you want to do a field trial, you have to say what day that would be. You have to notify them at least 20 days before you do that.

Kate Green: I see. Thank you.

The Chair: If there are no other questions, I thank our witnesses for appearing and giving us such full answers. The Committee will meet again on Tuesday 5 July in Committee Room 11 to begin line-by-line scrutiny.

Ordered, That further consideration be now adjourned. *—(Gareth Johnson.)*

4.57 pm

Adjourned till Tuesday 5 July at twenty-five minutes past Nine o'clock.

Written evidence reported to the House

GTB04 RSPCA

GTB05 Professor Toby Bruce, Keele University

GTB06 Animal Aid

GTB07 13 animal protection NGOs (Compassion in World Farming, Wildlife & Countryside Link, Conservative Animal Welfare Foundation, Humane Society International UK, FOUR PAWS UK, Save the Asian Elephant, Animal Equality UK, Animal Interfaith Alliance, The Shellfish Network, League Against Cruel Sports, World Animal Protection, The Humane League UK, Crustacean Compassion) (joint submission)

GTB08 Professor Jonathan Jones FRS, and US National Academy of Sciences, and Group Leader, The Sainsbury Laboratory, Norwich

GTB09 Nuffield Council on Bioethics

GTB10 GeneWatch UK