PARLIAMENTARY DEBATES

HOUSE OF COMMONS
OFFICIAL REPORT
GENERAL COMMITTEES

Public Bill Committee

GENETIC TECHNOLOGY (PRECISION BREEDING) BILL

Third Sitting

Thursday 30 June 2022

(Morning)

CONTENTS

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not later than

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

Professor Gideon Henderson, Chief Scientific Adviser, DEFRA

Professor John Hammond, Group Leader, Genetics, Genomics, Immunology, The Pirbright Institute

Professor Bruce Whitelaw, Director, Roslin Institute

Dr Craig Lewis, Genetic Services Manager Europe and chair for the European Forum of Farm Animal Breeders, Genus

Dr Elena Rice, Chief Scientific Officer, Genus

Dr Peter Mills, Assistant Director, Nuffield Council on Bioethics

Dr Madeleine Campbell, British Veterinary Association member, RCVS Recognised Specialist in Veterinary Reproduction (Equine), and European Diplomate in Animal Welfare Science, Ethics and Law

Peter Stevenson OBE, Chief Policy Adviser, Compassion in World Farming

Public Bill Committee

Thursday 30 June 2022

(Morning)

[Esther McVey *in the Chair*]

Genetic Technology (Precision Breeding) Bill

11.30 am

The Chair: I have a few reminders. Please switch off electronic devices or turn them to silent. Tea and coffee are not allowed during sittings. *Hansard* colleagues would be grateful if Members could email their speaking notes to hansardnotes@parliament.uk. Jackets can be removed if Members are feeling the heat.

I understand that the Government wish to amend the programme order agreed by the Committee on Tuesday 28 June in order to hear again from Professor Gideon Henderson, chief scientific adviser at the Department for Environment, Food and Rural Affairs, who experienced some technical issues when contributing on Tuesday. Because the motion has not been agreed by the Programming Sub-Committee, it can proceed only if everyone is content. Does anyone have an objection to the motion being considered?

Ordered,

That, the Order of the Committee of 28 June 2022 be varied so as to omit the eleventh and twelfth rows in the table and substitute the following—

Thursday 30 June	Until no later than 11.45 am	Professor Gideon Henderson, Chief Scientific Adviser, Department for Environment, Food and Rural Affairs
Thursday 30 June	Until no later than 12.25 pm	The Roslin Institute; Genus; The Pirbright Institute
Thursday 30 June	Until no later than 1.05 pm	Nuffield Council on Bioethics; Dr Madeline Campbell, Senior Lecturer in Human-Animal Interactions and Ethics, Royal Veterinary College; Compassion in World Farming—*(Jo Churchill.)*

Examination of Witness

Professor Gideon Henderson gave evidence.

11.31 am

The Chair: We will now hear oral evidence from Professor Gideon Henderson, chief scientific adviser at DEFRA, who is with us today in person. Before calling the first Members to ask a question and before allowing the professor to introduce himself, I remind all Members that questions should be limited to matters within the scope of the Bill, and that we must stick to the timings of the programme motion that the Committee has agreed. That means that for this first session we have until 11.45 am. Professor, would you like to introduce yourself briefly? Then we will start with questions from the Minister.

Professor Henderson: Hello. My name is Professor Gideon Henderson and I am chief scientific adviser at DEFRA.

Q135 The Parliamentary Under-Secretary of State for Environment, Food and Rural Affairs (Jo Churchill): Welcome, Professor Henderson. I would like to start with a broad question. Are you content that this Bill is based on the best available science? I would like to understand from your point of view why you think this legislation is necessary now, and why we should not wait for some of the more technical details, which have been asked for, to be developed.

Professor Henderson: I am content that this Bill is scientifically sound. I have given it a great deal of attention and have called on a great many expert witnesses through informal and formal processes. I have interacted with a large number of stakeholder groups over the past 18 months, and I am content that there has been due scientific scrutiny and that this Bill is based on sound science and agreed science.

It is important to move forward with this Bill for several reasons. There are very significant benefits to the environment, human health and resilience to climate change that can accrue from precision bred organisms. The technologies that we can harness to derive those benefits are now sufficiently mature that we are ready to capitalise on them. The UK is well positioned to do that. Many other countries have already made the use of such technologies easier, and it is time for the UK to catch up and it is safe to do so.

Q136 Jo Churchill: Can you say how you work across the four nations? Can you talk about the involvement of the whole of the UK in the evidence gathering that you have been doing?

Professor Henderson: There are two sides to my answer, one of which is the scientific side. The scientific body of knowledge is, of course, shared across the world and certainly across the four nations, and there is strong expertise in gene editing and the technologies we are talking about today in the devolved nations, as well as in England—certainly, those strengths are quite considerable in Scotland and Wales. The UK as a whole is very strong in this area, scientifically.

At a governmental level, there have also been significant discussions between Government scientists. I talk to my counterparts in Scotland, Wales and Northern Ireland, and I have been sharing information with other officials and sometimes with Ministers in the devolved nations as well. I think there is agreement about the science across the four nations, but not always about the policy direction.

Q137 Daniel Zeichner (Cambridge) (Lab): Good morning and welcome, Professor Henderson; it is very good to see you in the flesh. Can I start by saying on behalf of my hon. Friend the Member for Newport West that she has unfortunately tested positive for covid? She was engaged with dialogue with you when the video link went down the other day, Professor, so I will possibly be slightly greedier with questions today.

I will not be repeating the questions we went through last time, but go on to some other things. I was particularly struck by the written evidence from the Nuffield Council on Bioethics, members of which we will be hearing from later, and I want to put to you a couple of the questions that were raised in their evidence. They talked about something that I do not think we were aware of, which is that the Department is looking at its advisory frameworks in general. In reference to the Bill, obviously the Advisory Committee on Releases to the Environment looks like it will play a significant part, so could you say a little bit about what discussions have been had as to whether that is really the appropriate body, or whether some new body should be formed to oversee these complicated trade-offs and issues?

Professor Henderson: There are a number of things that that might refer to. There is a periodic review of how we get advice—scientific and otherwise—into DEFRA, and such a review is ongoing at the moment. I think it is entirely safe to say that that will not impinge on ACRE's activity. It serves a critical function already, and has an expanded role through this Bill to identify when things are precision bred organisms and when they are not. To me, that body seems to be the right place to attend to that type of decision about whether something is a PBO or not. There are also questions about animal welfare, and it may be that other bodies are required to adjudicate in that area, but that is for further down the line.

Q138 Daniel Zeichner: But you would agree that, as it stands, the Bill is fairly thin in that area. It sets up a structure, but it does not really talk about what the right body might be.

Professor Henderson: Again, I will divide that into two. I believe there is clarity about the role of ACRE, and ACRE has published guidance about the definition of a PBO, which has been scrutinised and, I think, generally found to be appropriate. As for, "What is a PBO?", the advisory system is in a good place. On the animal welfare aspects, there is perhaps some more thinking to be done.

Q139 Daniel Zeichner: Of course, the advice came out after the statutory instrument, but we will not go into that. That was a debate in the past.

I would like to pick up on a point that the Nuffield group has made about the release of precision bred organisms. It said:

"On our reading of the Bill, this means that precision bred animals that are not transgenic organisms may be released without further authorisation, without even a 'precision bred confirmation'. Such releases could have significant effects on existing ecosystems (for example, if they should have a reproductive advantage over wild organisms of the same species). This may be a matter of significant concern to other UK and wider jurisdictions as such animals may travel freely across jurisdictional boundaries."

Is that something that you have considered? What would be your response to that concern?

Professor Henderson: There is a notification requirement and the necessity for permission from the Secretary of State before things can be released. There are some appropriate mechanisms to scrutinise things as they pass through the process, but in general, the scientific evidence is that if something is mimicking traditional breeding and therefore is a precision bred organism according to the definition, the risks of release are no greater than those of a traditionally bred organism, and may be lesser.

Q140 Daniel Zeichner: Okay, thank you. I am conscious of time, Ms McVey, so I will do one more, but I do have some further questions if there is time. Clause 1(6)—this is at the beginning of the Bill, where there is the quite complicated list of definitions—says:

"In determining whether a feature of an organism's genome could have resulted from natural transformation, no account is to be taken of genetic material which does not result in a functional protein."

The Nuffield group says:

"The intention of this provision is unclear to us."

It is unclear to me as well. Could you explain it?

Professor Henderson: I can explain it. Actually, it is related to the questions you asked me last time. During traditional breeding, in nature and during precision breeding, it is commonplace for some transgenic—some exogenous material—to cross into the genome, but most of that has no functional role at all and does not impact on the phenotype. This clause is pointing to the fact that if there is some such material, it does not matter, as long as it does not create any function. This clause is seeking to say that if it creates a function and it is exogenous, then this thing will fall outside the definition of a PBO.

Daniel Zeichner: That is helpful. I am sure you are aware that there are other views on that. Thank you, Chair.

Q141 Deidre Brock (Edinburgh North and Leith) (SNP): You spoke about discussions with the devolved Administrations about this. I heard this morning that the discussions around this did not go through the common framework procedure. Are you able to tell me why that was?

Professor Henderson: I am afraid I am not. As a chief scientific adviser I am here to talk about the science. I spoke to my scientific counterparts and officials in the devolved Administrations who have a scientific interest, but I am not aware of the process you are talking about.

Q142 Deidre Brock: I am told that it is only being offered retrospectively, which seems odd. Obviously, Scotland has said that it will wait until the consultation with the EU is completed. What will happen if the EU goes down a different route with gene editing and genetically modified organisms? We are trying to export products to the EU but the EU Commission's first question, probably quite rightly, will be, "How do you prove whether the product is non-gene edited or gene edited?" Once it is in the environment, as I understand it, it is very difficult to remove, particularly in the case of crops. How will we do that without labelling and proper traceability schemes?

Professor Henderson: This is a double-edged sword because it is genuinely scientifically impossible to tell precision bred organisms from traditionally bred organisms in some cases, and therefore this will become a problem, regardless of the legislative environment that we work under, and it will be harder and harder to trace these types of organisms through systems globally, not just in the EU.

In terms of this legislation, all varieties that are approved for growth will be on a seed varieties listing and will be designated. It will clear that they are PBOs, as per their listing. So if you are shipping tomatoes or something, it

will be possible for that to be a discrete product that can be traced to the extent that is required through that process.

It becomes more problematic with products where things may be blended, and then it will be up to the producers or those selling to make sure that they have a supply chain that will satisfy the people they are selling to.

Deidre Brock: Right, fine.

The Chair: Order. I just want to say there are two minutes left.

Q143 Deidre Brock: I have one question left. If a gene edited animal breeds with a non-gene edited animal and produces offspring, how would they be described? What label could be used to describe those products?

Professor Henderson: Just to make sure I understand you correctly, are you talking about a precision bred organism breeding with a non-precision bred organism?

Deidre Brock: Yes.

Professor Henderson: You might be better placed asking this question to animal breeders later today, but I imagine this is to do with the way in which you describe the varieties and the strains of livestock when you are sending it to market.

Q144 Deidre Brock: Yes. Are you saying you cannot answer that and that I am better off speaking to animal breeders?

Professor Henderson: From a scientific point of view, I will again come back to the point that a precision bred organism and precision bred livestock is scientifically equivalent to something that could have been produced with traditional breeding approaches, so scientifically that coupling would not create a concern.

The Chair: We have just under a minute. Do you have a question, Daniel Zeichner?

Q145 Daniel Zeichner: Hopefully we can get this in in 30 seconds. The precautionary principle in general has been much discussed and Lords Committees are querying the current Government's current interpretation. What impact does this Bill have in terms of the precautionary principle? Does it abide by the traditional interpretation of the precautionary principle going back to 1992, for instance?

Professor Henderson: I will avoid getting into a discussion about the precautionary principle because that would be long, and there are even multiple definitions of the traditional interpretation of the Bill. I believe that the Bill we are putting forward now is precautionary—it follows the guidelines of the precautionary principle. We are not leaping in with both feet, but we are moving in stepwise motion.

The Chair: Order. We have come to the end of the time allocated for the Committee to ask questions. I thank Professor Henderson on behalf of the Committee.

Examination of Witnesses

Professor John Hammond, Professor Bruce Whitelaw, Dr Craig Lewis and Dr Elena Rice gave evidence.

11.45 am

The Chair: We will now hear evidence from Professor John Hammond, group leader of genetics, genomics and immunology at the Pirbright Institute. He will be appearing via Zoom. We will also hear from: Professor Bruce Whitelaw, director at the Roslin Institute, who is with us in person; Dr Craig Lewis, genetic services manager Europe and chair for the European Forum of Farm Animal Breeders at Genus, also with us in person; and Dr Elena Rice, chief scientific officer at Genus, who is appearing via Zoom. The session will run until 12.25 pm. Starting with Professor John Hammond, will you all briefly introduce yourselves, before we go to questions?

Professor Hammond: I am Professor John Hammond and I work at the Pirbright Institute. I look after the science responsible for improving post-livestock genetics to increase disease resistance and resilience.

Professor Whitelaw: Hello, I am Professor Bruce Whitelaw. I hold the chair of animal biotechnology at the University of Edinburgh. I am also the director of the Roslin Institute and have led projects there that have generated genome edited livestock.

Dr Lewis: I am Craig Lewis. In my current role I oversee the implementation, design and execution of practical animal breeding programmes for a subunit of Genus called PIC. Prior to that, I hold advanced degrees in animal genetics, from Roslin, and animal welfare.

Dr Rice: Good morning. I am Elena Rice and I am the chief scientific officer for Genus. I am overseeing the research programme across our business units, PIC and ABS. We are a world leading animal genetics company.

Q146 Jo Churchill: Thank you, lady and gentlemen, for appearing this morning. To Professor Hammond first, I would like to understand your broad thoughts on precision breeding in animals. How do you think the technologies that we are talking about can support research into bringing disease resistance forward in animals?

Professor Hammond: Where we have got to with the precision breeding methodologies in the Bill now supports decades of primary research in the UK and other countries. We understand the complex genetics underlying health traits and, in particular, disease resistance, which is a complex biological process. Because of those advances, and the work that we and others are doing, we are identifying genetic variants that may exist naturally, which, in combination or isolation, can dramatically increase disease resistance and resilience in farm animals.

The ability to undertake precision breeding, which would be the equivalent to the natural variation that we find in those populations, is an almost transformative technology to improve animal welfare and production—for example, there would be a lack of wasted carbon caused by disease. I think it has a really important potential for planetary health in terms of climate change.

Q147 Jo Churchill: Thank you. Professor Whitelaw, can you tell us a little about the work that Roslin has already done in this area, how you consider animal welfare, and how that work might or might not help in mitigating external stresses that farm and other animals have from external diseases?

Professor Whitelaw: Roslin has been involved in a number of species: pigs, cattle, small ruminants and poultry, primarily chickens. We are also now looking at research to do with aquatic species. The main driver of that research has been to reduce stress impact on the animals, and we have focused on disease, partly because it is one of the main stresses imposed on animals around the world, but also because we have a lot of knowledge. As my colleague John just indicated, we have a lot of genetic knowledge and a lot of knowledge around the actual pathogens themselves.

There are two projects that have the highest profile. One is to do with pigs and relates to a disease called porcine reproductive and respiratory syndrome, and we have done that in collaboration with Genus PIC. The other area we have been looking at extensively is around influenza—primarily in chickens and poultry, but also in pigs—and there are other diseases behind that. From a research perspective, disease is a very challenging topic, but we have a lot of knowledge. There are other stresses that we are looking at, such as heat tolerance. We are looking at the impact of reproductive issues on animals, and these can all be addressed by using genetic technologies, including genome editing.

Q148 Jo Churchill: Where do you think UK science sits in this area globally?

Professor Whitelaw: We are very fortunate that we punch above the size of our island and have been leading in the area of livestock for some considerable time. We all know the reason why Roslin has a high profile: it is because of a certain sheep called Dolly, which was 26 years ago. That whole project was around genetic engineering, and the same exists in the plant community. We have some really strong players in the academic arena. We do not have the numbers that exist globally, but we do sit very well within that. I will quite happily say we are leading, and I will quite happily say that Roslin is a leading player in that too.

Q149 Jo Churchill: My final question is to Dr Rice and Dr Lewis. Can you talk a little about your work on PRRS, and where does that collaboration with the university go next? Is this something that you will be optimising globally, given that we do not yet have the right regulatory framework in this country?

Dr Lewis: To put it into some context, I grew up on a pig farm in Herefordshire, so I have seen PRRS, or what was called blue ear disease here in the UK, at first hand with my father. The focus of my PhD work at Roslin was actually looking for natural variants in terms of PRRS resistance. Are there pigs out there—even today—that we could selectively breed so that we would not have to deal with this problem or could at least make the animals more robust? After three years at Roslin, the bottom line was that although we do a great job at creating genetic improvement to make more robust pigs generally—we can increase feed conversion, growth rate and so on—specific disease resistance is obviously a very complicated trait. This is an opportunity where we can almost create a natural variant, and therefore the mutation in the particular genome that confers the resistance; it would be wonderful if that just happened in the next generation completely naturally, but this is not a fairy tale—it is practical animal breeding. The ability to be able to create that variant so that we can actually implement this in a practical breeding programme, as John said at the beginning, is game-changing technology.

In terms of how that could impact globally, PRRS is endemic in multiple markets around the world. I have worked across the United States, which is very impacted by this particular disease. Right now, Spain is going through a very nasty strain of the PRRS virus. Here in the UK, whether it is indoor intensive units or the outdoor pig units in Norfolk, East Anglia, which we see when we drive around, we have PRRS outbreaks. That is a difficult scenario, for the pigs, obviously, in terms of morbidity and mortality, but there is also a human element. People like my father are deeply impacted when their animals are sick. Fundamentally, that is why I got into science. The scope of delivering truly disease-resistant animals impacts so much, as we look at this technology.

To get into the science, I will hand over to my colleague, Elena.

Dr Rice: The question was where are we today with the development of PRRS-resistant pigs. Today, we have quite a large population of animals that are not the first generation. We did the edits and already bred animals that carry the resistance to the virus. Those animals have been tested in disease challenges and we showed that they are completely 100% resistant to the virus. Because of this small edit in one gene, those animals do not see the virus and cannot get sick, which means that they do not require extensive application of antibiotics on the farm. In our process, we are building a commercial herd now. We are going through the accrual process with the US Food and Drug Administration. The process is very successful. We are moving forward and are actually accelerating our studies. We hope to see approvals in late 2023 or the beginning of 2024. So this is real and it is here.

We are also working with regulatory agencies in other countries, such as Japan, Canada and South Korea, and we are expanding our interaction with many other countries. What we see today is that there is a very clear path in all those countries to get approval for the animals and bring them to the market.

Jo Churchill: Lovely, thank you very much. A clear path is what we are aiming for.

The Chair: A number of Members have signalled that they want to speak. I remind Members that this session goes to 12.25 pm. I will start with Daniel Zeichner.

Q150 Daniel Zeichner: I will try to be quick, Ms McVey. First, I think we need some clarity on what is being done where. The purpose of the Bill is to allow research to take place in the UK, and we have just been told the UK is a world leader. There seems to be some contradictions there. If that could be drawn out and explained, that would be helpful.

My second question is for Genus. These opportunities are fantastic. If we can deal with influenza and PRRS, that is a fantastic opportunity, but can you explain to me how the intellectual property rights will work? Who owns this? How does it get transferred from country to country? That is quite a big question, but if you could do it fairly briefly, that would help everybody.

Professor Whitelaw: Good question. I will start off and then pass over to Genus colleagues. The first question was about how we can be world leaders and need the Bill. All the work that goes on at the Roslin Institute is contained use under the Animals (Scientific Procedures) Act 1986. It is an experiment that is done in our labs or on our farms. We, the university, are the inventors and we are the owners of that. Our commercialisation organisation at Edinburgh University is Edinburgh Innovations, which negotiates with a third party to get access and a licence to that IP. In this case, we have negotiated a commercialisation licence with Genus to take it forward into the market. All the work at Roslin is done there under ASPA contained use. That is the research base. That is where we lead with the development of intellectual property and develop the projects.

Dr Rice: I had a small problem hearing the question, so maybe Craig can start.

Dr Lewis: I will leave all the IP pieces to Elena, because I am a breeder, not an IP lawyer—full disclosure. In terms of development, I think that one of the things we need to understand here, which Bruce hit on quite effectively, is that there is a big difference between the research stage and what I would call the scaling phase before implementation. It is not a matter of simply saying, "Okay, we have done great work at Roslin and have created a precision bred animal, which is going to impact on commercial animals here in the UK." There is a different step, because we need to be able to scale it. That comes back down to basic animal breeding and the structure of a breeding pyramid. We need to scale those animals to have enough of a population to be able to serve the commercial producers. That would happen.

I think there are opportunities for the UK. If we try to do the scaling step without a market, basically you will have major farms where 100% of the offspring cannot enter the food chain. That becomes a huge barrier to further innovation. We can do the very early stuff, but we would miss out that scaling step in the UK. A Bill that would allow us to access a marketplace would have the benefit of significantly reducing the cost of the scaling piece.

Q151 Daniel Zeichner: I suppose my question is to Elena. I get that point, but does this not put enormous power in the hands of one group of people who own the intellectual property around this particular form of the animal?

The Chair: Did you hear that question, Dr Rice?

Dr Rice: Yes, I think the question is about IP and how it is placed in the market. As Bruce just said, the university owns IP. It is possible for any company to license that IP and bring the research to commercial production. We did exactly that. We interacted and worked together for many years with the Roslin Institute. We have the ability to bring that research to the hands of producers and farmers. As Craig said, it actually takes a lot of work over many years. To give you an example, as a company, we have devoted around five to seven years now to actually taking it from the research stage from the Roslin Institute to learning and understanding how we can implement that particular edit in our elite breeding germplasm. Why is that important? Farmers and producers around the world want the best genetics that we can offer, but the best genetics need to be combined with the edit.

I want to quickly give you an overview of how it works. We make an edit in an embryo. Then we take the embryo and put it into an animal who carries the edited heritage. We create exactly the same edit in our founder lines. In this example, we have four founder lines that we created and edited. We select them and do thorough analysis for any potential off-target effects. We select only animals that carry no off-target edits. Then we breed those animals in many generations to provide the elite herd that will be distributed to our customers. I want to make sure that the animals that the farmers get are not touched by any instrument—that they are not edited themselves. They are bred from the initial set of animals that we have created. That is why it takes a long time and a lot of effort to bring it to the market.

Daniel Zeichner: I understand that point. Thank you.

Q152 Deidre Brock: Professor Whitelaw, I hope to visit you soon at the Roslin Institute, along with your local MP, who has spoken glowingly of you for some time. The Scottish Government want to wait for the EU consultation in this area to be complete before approaching gene editing in the way that the UK Government are. That presents potential problems if the EU decides to stay where it is or just moves marginally, or has a different approach from the UK Government's approach. If that happens, how do you see that affecting trade with the EU and our export trade there? This is the big concern for the Government. What is your answer to that?

Professor Whitelaw: I am not sure I can comment on export trade. It is not an area that I am knowledgeable about, but maybe I can comment more generally. One of the benefits of the Bill is to give momentum to investment in this area. I do not mean just money, but talent coming into the field, into the universities, and students knocking on my door and saying, "I want to do a PhD on genome-edited animals." I see that increasing and I see that as a huge benefit for the UK and for Scotland. To me as a researcher, that is one of the major drivers—to see that investment opening up. Yes, it will happen in the commercial world. We have seen how other countries that brought in legislation on genome editing have seen a proliferation of small and medium-sized enterprises and innovative ideas coming through. That is what I want to see come out of the Bill. That is the bit that drives me. I am really not knowledgeable about the impact on exports.

Q153 Deidre Brock: Dr Lewis, you were discussing the PRRS—the porcine reproductive and respiratory syndrome—that you are working on. Could you tell me how quickly, once this Bill comes law—if it becomes law—you will be able to scale up and it all becomes commercially available? If you could have a stab at that, it would be helpful.

Dr Lewis: It depends on the timeline and when the Bill would come into effect. Rather than talking about a specific gene edit, one way to also ask the question, even in the current state, is: when I produce an elite animal today, how long is it until it really impacts the whole flow of pigs? I can answer that perfectly today. Based on the structure of the pig industry, you have to have pure line animals, then you have to create crossbred animals that are the mothers of the commercial offspring, and then you use a terminal sire. Basically, if you look at

getting the whole pyramid to be 100% influenced by new genetics—you are putting in three different levels, three breeds coming together—that would roughly be about five years.

Q154 Deidre Brock: Five years. That is interesting. Thank you. I have asked other witnesses that question just to see how long it would likely take.

Finally, Roslin has got a tremendous reputation for really high quality research. Do you think the Bill guarantees the absolute traceability of gene edited products and also the strictest possible monitoring of what science is doing in this area, or is there more that could be included in the Bill to ensure that?

Professor Whitelaw: I will answer the science question, then touch on the traceability. Our science is very well scrutinised through current legislation, because it is under the contained use. We have to go through a variety of permissions before we do an experiment with animals, and that is visible. Therefore, I do not think the Bill will necessarily affect the regulation of what we are doing; but as I said, I hope it increases the volume of what we do.

When it comes to traceability, which was mentioned earlier, genome-editing technology generates the equivalent of what is naturally found. Every animal born carries 40 de novo mutations, and genome editing adds another one to that list. Without having an audit trail of individual animals, you will not be able to identify one genetic change from another. It is impossible to categorically say, "That is caused by genome-editing technology rather than a natural mutation." Therefore, the audit trail of an animal or product will not be based on the molecular analysis of that animal; it must be based on something else.

Q155 Deidre Brock: Which might be?

Professor Whitelaw: Craig might be able to answer this more clearly, but depending on the species, that might be breed books or production systems, which would be embedded within the companies or with different nations.

Dr Lewis: We should be very aware here that there is a species component to that. When we start thinking of cattle, for historical reasons, there is a very strong traceability element through the cattle chain. However, if we look at the pig industry in the UK, it is more done on a—shall we say—lot basis. For example, normal practice in the UK pig industry is to use pulled semen at a commercial level for a terminal sire, so even within a litter, you might have three or sires represented. That is today, so an individual animal traceability in the UK pig industry today does not really exist. When we answer the question on traceability and what exists today, that is very species-specific, rather than "This is the livestock sector."

Professor Whitelaw: This is the basis of all of my thinking. We are using these tools to create precision changes to the genome—changes that can happen naturally. There is no difference between those two. There is a difference in how they arise; one is because we choose to target a specific DNA sequence and change it, and the other is just a random lottery that evolution throws up. However, from the animal's perspective, and I would argue from our perspective, in how we look at these animals, it is just a genetic variation that exists. There is no difference. Going to the traceability question, why and what are you tracing?

Q156 Clive Lewis (Norwich South) (Lab): I know you do not deal with IP, but if it is a natural occurrence, why is IP applicable? Surely, it is not invention; it is a genetic coding. I am just keen to know why you feel you then have the right to impose intellectual property rights on something that, as you are arguing to us, is naturally occurring. Yet, you will impose intellectual property, I would imagine, to be able to make a profit. I am finding a logical failing there. That is just to put that one out there, and maybe you can come back on to that.

We have been dealing with crops so far, and we have now moved on to animals. I must admit that I am now beginning to struggle with this slightly. We are not talking about plants but about sentient animals, and about genetic modifications to them.

The thing I have been reading about PRDC—porcine respiratory disease complex—is that part of it comes down to environmental and conditioning factors. There are obviously some pig farmers, for example, who keep their animals in better conditions than others, but many do not. Even when you keep your animals in optimal condition, there are certain conditions that they are kept in that will encourage that disease.

My question is on behalf of the millions of people who are increasingly becoming vegan or vegetarian. We are now introducing genetic editing to enable us to keep those animals in sometimes quite horrific conditions. It is for this disease at the moment, but what is to say that exploitation of these animals is not going to only deepen? Now we can keep these animals knee deep in their own crap—sorry, Ms McVey—and we can edit their genes so they can survive in those conditions. That is how some people will see this and that is how much of the public will see it. Can you give me some reassurance that that is not going to happen? When profit is the bottom line, I see these animals becoming more robust and able to live in ever-more extreme and difficult conditions.

Dr Rice: Perhaps I can jump in. If you have read about PRRS virus, you will probably know that it is actually not dependent on conditions. Animals in the wild, as well as animals in production, all get sick. What actually happens on farms today is that farmers have to install multimillion filtration systems—because viruses are airborne—to filtrate outside air through very complicated filtration systems so that viruses cannot get into the farm. So it actually has nothing to do with the conditions.

Clive Lewis: I disagree with that. I am reading a peer review paper here—

The Chair: Allow the witness to finish.

Dr Rice: It is a reality today and you are welcome to visit those farm centres. I visited one two weeks ago, and I just want to tell you that when we are talking about conditions, I was at the farm and the animals looked beautiful. At the same farm, the owner was telling me that two months ago, he was walking into a room full of dead piglets. Why did that happen? It was because the mother got PRRS virus and it killed all her not-yet-born piglets and they were born dead. So when you walk into this room and see all the crates covered with dead bodies, it is actually very impactful on people's

minds and everything. People suffer mentally seeing those pictures. We have an ability to prevent that. It seems a little strange that we would say no, that they would have to continue to suffer like that, even though we have a tool to give them to completely avoid those types of situations for those poor animals. No, they are not maintained in very bad conditions; they are properly farmed. There are rights on those farms, I would say, but again, all the pigs are getting that and the main biosecurity precaution today is to prevent air from outside from bringing the virus to the farm.

Dr Lewis: I appreciate your questions and concerns, Mr Lewis. Let us just step back. First and foremost, I have the privilege of travelling the world and working with pig farmers all over the world. First and foremost, the UK should be very proud of its tradition of animal welfare and the UK farming sector's animal welfare standards. If I look at the most extensive and intensive systems here in the UK, both equally get PRRS virus. I struggle with that in many conversations with vets all over the UK. Really, the system does not dictate whether—

Q157 Clive Lewis: Can I make one point on that? I have to speak on behalf of many people in this country who would make the point that if you did not have animals as foodstuffs or even believe that we can keep them as pets—there are many people who think that; maybe not millions, but plenty—the fact that you are keeping them for the sole purpose of benefiting human beings, either as foodstuffs or for other products that they can create, is in itself part of the problem. I am just putting that down there. There is obviously a growing number of people who are becoming vegetarian and vegan with the climate crisis and so on who increasingly believe that. Now we are moving into a new phase of gene editing and all that comes with that.

Dr Lewis: I was just coming to that point. This is a conversation that I have actively had. I have had the privilege of being in a couple of public dialogues with Peter Nuffield. There is a great debate about where animal welfare, farming systems and the food system are in the UK today, but I do not think it is directly relevant to this Bill. If we say that animal welfare needs to change, we already have robust legislation and codes of practice for the UK on what animal welfare should look like and what the standards are. The debate about whether they should move or not is about the animal welfare legislation, and I believe it should be part of a public consultation.

Considering that that legislation is already in place, whether we have genome edited animals or not does not change how many animals we put in the pen; that is dictated by a separate piece of legislation. Just saying that we are going to have gene editing so that we can put more animals in the pen—

Clive Lewis: But here is my question—

The Chair: Mr Lewis, we are straying from the topic. I have to stop you because I have three other Members who want to remain on topic—Kerry, Andrew Bowie and Katherine Fletcher. We will move on because we have strayed off the topic. I have been very patient and I did let it go on for a little while.

Q158 Kerry McCarthy (Bristol East) (Lab): On a similar point to Clive's, I note what Dr Rice said about the virus coming from outside, but from my reading of the syndrome, it spreads by direct contact between animals, as well as by natural breeding, artificial insemination and a variety of other things. There is the concern that the more animals you have in one place, the more likely it is that the disease will spread.

I note that the syndrome was first identified in the States in the late 1980s, and now it has spread worldwide in most swine-producing countries. I would be interested to know your take as to why it has spread to that extent. Is it because there is more intensive farming, in the same way that we saw with things such as bovine TB? I get what you are saying about the farm animal welfare codes, although they are not very well adhered to—there is a separate debate about that. If this would permit more animals to be kept in intensive situations because the virus would not spread, does that not leave the door open to people to argue that that is the path we should be going down?

Dr Lewis: I appreciate the question. We can look at this in a couple of ways. Just as pure history—as I say, it was my pet project with my PhD—the PRRS virus was originally identified in two separate locations at the same time. One was in North America—Minnesota—and one in Lelystad in the Netherlands. It was pretty much simultaneously defined in Europe and the United States. Did the movement of animals globally—breeding stock and so on—facilitate the global spread? I think that is probably fair, but that needs to continue to happen as we move the geneplasm around the world and connect populations.

The number of stock is an interesting question. PRRS is very infectious, so once you have got it into a farm, it does not matter if there are 10 pigs or 100 pigs in the farm; the whole farm is probably going to get it. The way that you look at it is that the barrier to entry into the farm is more important than how many pigs are in the farm. That is why we continue to refine biosecurity practices.

Kerry McCarthy: I was talking more about proximity than about numbers.

Jo Churchill: Professor Hammond might be interesting on this, because he deals with avian flu, and obviously that might broaden it to the wild community.

The Chair: If you want to do that, you have less than a moment. It is for all Members to direct the questions to who they would like to hear answer them.

Q159 Kerry McCarthy: It is not so much numbers, but if you have a smaller number of pigs, they tend not to be kept in such close proximity.

Dr Lewis: My final point would be that if we look at gene editing, or genome precision breeding on the other extreme, one of the reasons why we keep animals inside is to protect them from disease, whether it is flu or PRRS. One different way of looking at it is that the use of precision breeding technology could facilitate the extensification of agriculture.

Professor Whitelaw: You have to remember that a virus does not choose which animal it is going to infect. It will infect an animal in whichever farming system it is in. This technology, equally, can benefit all farming systems.

The Chair: This session has been busy with lots of speakers and questions. I apologise that we did not get on to other Members. I want to thank Professor John Hammond, Professor Bruce Whitelaw, Dr Craig Lewis and Dr Elena Rice. Thank you very much for your time.

Examination of Witnesses

Dr Peter Mills, Dr Madeleine Campbell and Peter Stevenson OBE gave evidence.

12.26 pm

The Chair: We will now hear oral evidence from Dr Peter Mills, assistant director at the Nuffield Council on Bioethics, who is with us in person; Dr Madeleine Campbell, British Veterinary Association member, RCVS recognised specialist in veterinary reproduction and European diplomate in animal welfare science, ethics and law, who is appearing via Zoom; and Peter Stevenson OBE, chief policy adviser at Compassion in World Farming. This session lasts until five minutes past 1. Again, if everybody could be mindful of that and direct their question to the witness they would like to answer it. Could each of the witnesses introduce themselves for the record, starting with Dr Peter Mills?

Dr Mills: Good afternoon. I am Dr Pete Mills. I am assistant director at Nuffield Council on Bioethics.

Dr Campbell: Good afternoon. I am Dr Madeleine Campbell. I am the current chair of the British Veterinary Association's ethics and welfare advisory panel. If I may briefly correct something you just said, I am actually an RCVS recognised specialist in animal welfare science, ethics and law and a European diplomate in animal reproduction.

Peter Stevenson: I am Peter Stevenson. I am chief policy adviser at Compassion in World Farming. I am a solicitor by background, although I do not do all that much legal work nowadays.

Q160 Jo Churchill: Good afternoon and welcome. I would like to address my first question to Madeleine. I believe you have argued that it is an ethical imperative that we make use of precision breeding. Do you believe this is a tool that could be used to maintain and potentially improve standards of animal welfare?

Dr Campbell: To clarify, I did indeed argue that at a recent Animal Welfare Foundation event in the course of a debate. I was slightly making an argument, but yes, we do feel that genetic editing of animals could play an important role in enhancing animal welfare and in the broader context of enabling agriculture to develop in a sustainable way, which would minimise the impacts of animal agriculture on the climate and the environment. Yes, it has great potential to do good, but it also has great potential to do harm from an animal welfare point of view. As I say, it needs to be thought about very carefully.

Q161 Jo Churchill: Lovely, thank you. Moving on to Dr Mills, what are your thoughts on the potential opportunities to transform the food and farming system? Given that caveat from Dr Campbell, what do you think are the big questions we should be asking?

Dr Mills: The Bill is a very welcome initiative. The Nuffield Council does not believe that the retained EU regulatory regime is fit for purpose. One of the shortcomings of that regime was the way in which it was relatively indifferent between plants and animals. We believe that the potential power of genome editing as a technology merits some control, so we are pleased that the Government have brought forward this Bill to do that.

The Bill addresses a number of potential mischiefs that could occur as a result of the use of those new technologies. It is perhaps a little bit unambitious in the sense that it leaves a vacuum at the heart of the governance system that applies to breeding technologies. You heard evidence in the previous session about the Animals (Scientific Procedures) Act 1986, which is primarily focused on experiments on animals. The Animal Welfare Act 2006 was also mentioned, which is to do with the treatment of animals in different settings. There is nothing at present that controls the production of animals of particular kinds.

The precision breeding Bill—despite the title—does not, in a sense, control precision breeding or genetic technologies, except indirectly by causing breeders to anticipate the conditions under which they will be able to market the products of their breeding. What is missing is some more positive statement or principle about the purposes for which precision breeding—and breeding more generally—might be used. As we argued in the Nuffield Council report, breeding of all kinds should be directed towards securing a just, healthy and sustainable food and farming system. Having something like that in the Bill as a framework, within which standards can be elaborated through regulations and by the relevant authorities, would be extremely helpful.

Q162 Jo Churchill: I think we will put that in work in progress for discussion. As we have just heard, there is a broad spectrum as to what one might be working with. My final question is to our final panellist, Mr Stevenson. We have heard evidence about the Bill's potential for good, given the common goals of tackling climate change, reducing disease and so on. While being aware of further discussions, what is the evidence that we should not move forward with the legislation to the benefit of animal welfare, broader animal disease, enhancing food security and tackling climate change?

Peter Stevenson: I am afraid that I have serious misgivings about gene editing. I think it is going to do a great deal of harm, both during the creation of gene edited animals and then when it is used on farms. Having said that, I recognise that there will be certain cases where it can be beneficial. For example, Compassion in World Farming is working quite closely with a company that is trying to gene edit hens to not produce male chicks. That would prevent millions of male chicks being killed at a day old every year. We are not totally against it.

For me, at the root of the problem is that the Bill argues that gene editing is just a more precise form of traditional breeding, such as selective breeding. If you look at the last 50 years, selective breeding has caused immense health and welfare problems for farmed animals. Meat chickens have been bred to grow so quickly that millions suffer from painful leg disorders each year, while others succumb to heart disease. We have bred dairy cows to produce such high milk yields that many are suffering from lameness, mastitis and reproductive disorders, and the cows live with these welfare problems for a large part of their lives. We have bred hens to

produce 300 eggs a year. As a result, many suffer from osteoporosis, making them highly susceptible to bone fractures.

The idea that we will push all this further through gene editing is really worrying, but if we are going ahead with this, which is the clear intention, I think—I am now speaking as a solicitor—that the animal welfare protections in the Bill are drawn in very broad language. They are imprecise and unclear, and they need to be given more focus and strength, so I would love the Government to revisit those provisions.

Q163 Jo Churchill: Thank you very much. Professor Whitelaw, who is still in the room, laid out in previous evidence that gene editing is akin to traditional breeding, but you do not believe in the science as it has been put forward to us—that this is akin to traditional breeding. In the answer, there was both, "Yes, we agree that it can be positive" and "No, we don't think it can be positive." Can you clarify that? Professor Whitelaw was quite definitive about the benefits.

Peter Stevenson: In 30 years of working in this field, I have never tried to assert anything that is not supported by the science. I have tried to say that gene editing could be helpful in certain and very limited circumstances, but that it will be harmful overall. The science about the detrimental impact of selective breeding on just about every main farm species is utterly clear. There is a huge amount of science on the subject, some of which comes from the Farm Animal Welfare Council, which is now called the Animal Welfare Committee. I totally reject any suggestion that what I have said about the damage done by selective breeding is not based on the science. As I say, the idea that we will push this further and drive animals to even higher yields, faster growth and larger litters through gene editing is really disturbing.

Jo Churchill: Okay. I will leave it there.

Q164 Daniel Zeichner: Dr Campbell, may I ask you about the potential future risks, the extent to which we know or do not know the impact on animals, and how we might monitor or check that in the future? Are there sufficient provisions in the Bill to deal with those issues, based on your professional experience?

Dr Campbell: That is a key question. When we talk about whether gene editing will be beneficial or detrimental from an animal welfare point of view, as we have just been discussing, we need the evidence to look at that. I do not feel that the Bill as drafted will provide a mechanism for doing that.

At the moment, the Bill has a mechanism specifically for applications for marketing authorisations to be referred to the animal welfare advisory body. It is somewhat open in Bill as to exactly what that body is, as I understand it; it could be an existing body, or a new one. What will be crucial is that we have a proper mechanism in place to have oversight not only of the marketing and the release of any genetically edited animal organisms, but of the actual processes that are going on with the so-called precision breeding, so the animal welfare advisory body needs to have oversight of those processes as well, and that needs to be an obligatory oversight. It needs to have an obligatory reporting role too.

This needs to be an independent body, with suitable expertise to understand and interrogate both the basic science and the animal welfare science, and to understand and explain the ethics around that. It must be independent of Government and of scientists, and it must be independent of any lobbying—around trade, for example. Then it needs to be able to look both proactively and retrospectively at data about the health and welfare of animals that are produced using so-called precision breeding techniques. It would be an independent oversight body—in my mind's eye, very analogous to the Human Fertilisation and Embryology Authority—that can take an independent look at the data and then make recommendations for policy changes in light of that data, as the science develops.

Q165 Daniel Zeichner: Could you say a little more about that final point—the potential benefits that you would see coming from something like that authority?

Dr Campbell: I am sure you heard in the previous evidence—I was not in the meeting to hear that—that there is still some uncertainty about the effects of genetic editing, in particular the so-called off-target effects. Exactly because of the nature of the techniques, those can be effects not only on one generation of animals, but on many future generations of animals. One could approve something now, but a generation or more down the line, the evidence could become available that would cause you to reconsider that opinion. That is exactly what this independent body would be doing. It would be gathering data about the health and welfare of the animals produced using precision breeding techniques and independently analysing that data, and then making recommendations about whether policy and/or legislation needed to be updated in the light of the developing scientific evidence about health and welfare effects.

Q166 Daniel Zeichner: Finally, do you see anything in the Bill as it is currently drafted that allows that to happen?

Dr Campbell: No. As I understand the Bill, at the moment there is within the regulations some kind of optional reporting function for that animal welfare advisory body—which, as I say, is not very well specified—but there is no obligatory function. I think it absolutely has to be an obligatory reporting and oversight, data collection and analysis function, and that animal welfare body—whatever it is—needs to be better defined and specified within the Bill, and it needs to be constituted specifically for this purpose, with the relevant expertise within it.

Q167 Daniel Zeichner: Thank you. Dr Mills, I have already said that I have been very influenced in my thinking by your larger reports and the evidence to the Committee. Very briefly, what are the key things that you think could be done to improve the Bill?

Dr Mills: I am very grateful for the recommendation for our report.

I have said already that I think that what is perhaps lacking is a framework that sets out positive purposes for precision breeding—a framework in which a body of the sort that Dr Campbell referred to could elaborate standards that could then be applied independently to precision breeding.

The thing about breeding is that we are talking not about one animal, but about a lot of animals. We are talking not about simply the next animal, but about the potential trajectory that is followed by a practice that results in future conditions in the food and farming system. Some attention should be given to those things.

The other thing that struck me coming off the page of the draft legislation was the fact that there was a focus on the individual traits being modified, but of course welfare is not about one trait. The welfare of the animal is about the interaction of a range of traits at the molecular level and the phenotypic level, and it is about the interaction of that set of characteristics of that animal with the environment. What breeding is doing is trying to develop animals and fit them to particular environments, and consideration needs to be given to that as a more general theme.

I am extremely pleased that the Government have taken note of the fact that welfare is an important ethical issue affecting animal breeding, but it is not the only one. A range of other considerations need to be taken into account when one is directing a breeding programme, and those are a range of considerations that are of public interest, and therefore properly, I think, the subject of public policy.

Daniel Zeichner: I am conscious of time, Ms McVey, so I will come back to Peter if I have time.

The Chair: If we could all be conscious of time, please.

Q168 Deidre Brock: Nuffield Council has obviously welcomed aspects of the Bill, but there will be a lot of detail required in legislation that we have yet to see. A lot of it seems to subject to the negative procedure as well. If the Bill is amended as it goes forward, what are the main areas that you want strengthened in regulation?

Dr Mills: I concur with Dr Campbell. In the first place, there is quite a lot that is opaque or simply missing, because it is subject to further regulations. It is unfortunate in some respects that you will have to debate the Bill with those uncertainties in front of you. It would be nice to see the constitution and membership of the animal welfare advisory body, for example, specified. The powers, resources, reporting lines and enforcement functions will be really important in thinking about how well whatever government system we end up with for precision breeding functions.

Q169 Deidre Brock: Would you speak a little about the point you make in your document about the release of precision bred organisms, and about the reassurance you are seeking on the inclusion in primary legislation of a minimum prescribed period for those proposed releases? How might that be published? What time would be needed to examine that? What are your thoughts on the current shortcomings on those issues in the Bill?

Dr Mills: This may be a minor and easily remedied technical point, but certainly from my reading of the Bill, it struck me that in order to release a precision bred organism one had to comply with part 2 obligations and notify the Secretary of State. If that organism was not being made available, however, or marketed, I do not think there is any further obligation to secure prior permission. If that is the case, at the very least the power to make regulations to provide a period during which that release can be examined, representations made, decisions reached and possibly enforcement powers brought to bear should be given effect. That power should be exercised mandatorily rather than at the discretion of the Secretary of State.

Deidre Brock: Did you want to say something, Mr Stevenson?

Peter Stevenson: Yes, if I may. As I said earlier, I think the animal protection provisions in the Bill need to be clarified and strengthened. For example, clause 11, requires an applicant for a marketing authorisation to assess and identify the welfare risks, and clause 12 says the welfare advisory body must then make a report on whether the applicant has properly identified and assessed the welfare risks. To some degree, the way it is written puts the applicant in the driving seat—playing the lead role in determining which welfare risks will receive primary consideration. The Bill needs to be amended to make it clear that it is the welfare advisory body that is in the lead. Of course it will look at the information supplied by the applicant, but the Bill must require the advisory body to carry out its own independent, far-reaching investigation into the possible welfare risks. It should not be fettered by just what the applicant has said.

Deidre Brock: Thank you.

Q170 Clive Lewis: Mr Stevenson, if you could change the Bill, what are the key changes you would make? For example, do you agree ethically with the plant component of the Bill, in terms of gene editing plants, but not the animal side? You have talked about some of the changes that will need to be made on welfare and about putting the farmer, or whoever it is, in the driving seat with the changes you talked about just now. I am keen to know if you make a distinction between plant gene editing and animal gene editing. Does the Bill go far enough in the revisions that it makes to deal with gene editing of animals, or do you want to throw it out completely?

Dr Mills, on gene edited exports, one presumes that once this biotechnology is achieved, it does not make a difference what welfare rights we have in this country for animals. A big part of the Bill is giving British biotechnology the ability to get out in front on this, and we could then sell that technology to other countries that have much lower animal welfare standards. Is that a concern?

Peter Stevenson: I do not know enough about plants to give a proper opinion. When it comes to the animal side, as I said earlier, there are a few cases in which I think gene editing could be beneficial, but ideally I would like to see animals removed from the Bill and much more thought given to how gene editing is going to be used and what protections should be there before legislation is introduced.

For example, the arguments that gene editing can be beneficial in terms of disease resistance have been overstated. Yes of course, if you are looking at diseases that have nothing to do with the way animals are being kept, gene editing for disease resistance can be helpful, but the science is absolutely clear that many diseases stem from keeping animals in intensive conditions. Very specifically, the crowded, stressful conditions in intensive livestock

production can lead to the emergence, the spread and the amplification of pathogens. Gene editing should not be used to tackle such diseases. These diseases should be addressed by keeping animals in better conditions. There is a very real danger that if you gene edit for resistance to diseases that primarily result from keeping animals in poor conditions, that could lead to animals being kept in even more crowded, stressful conditions, because they may be resistant to the diseases that are inherent in such conditions.

Having said all that, I suspect Government isn't about to drop animals from the Bill. I have talked about how the Bill should be strengthened in terms of giving a stronger central role to the welfare advisory body, but it also needs to be strengthened in setting out what that body should be looking at. The Bill is very unusual. Usually primary legislation provides more definition.

For example, the welfare advisory body should be looking for things like a piece of gene editing aimed at animals growing faster or providing higher yields, and asking, "Has this caused a problem for animals that have been selectively bred for such purposes?" If it has, it should be very careful and look at whether that is likely to happen with gene edited animals. It should also be asked to look at whether the desired objective of the gene editing could have been achieved in less intrusive ways. An awful lot more thought needs to be given to the use of gene editing in animals.

I will add one point. It is more than 50 years since Ruth Harrison's book "Animal Machines" first alerted us to the dangers of intensive livestock farming, yet gene editing is doing exactly that: treating animals as machines that can be fine-tuned to make them a bit more convenient for us. The Bill sits at considerable odds with the recent Animal Welfare (Sentience) Act 2022 that regards animals as sentient beings. The two do not mesh.

Dr Mills: To pick up on what Mr Stevenson said and to clarify, the Nuffield Council certainly sees many benefits in genome editing as applied to animals. Unlike perhaps a number of other commentators on the issue, we does not see genome editing as necessarily being the last resort. We recognise that, in some cases, there are social conditions that are every bit as intractable as the biology of animals; indeed, given the technologies that are becoming available to us, the biology of animals is perhaps more tractable. Our way of approaching this is to treat those things symmetrically and to consider in what way different interventions might promote a just, healthy and sustainable food and farming system, taking into account the interests of the people and animals that are dependent on that system.

You asked about the technology being sold to countries that have lower animal welfare standards than the UK. I am very happy to live in the UK, a country that does respect animal welfare. Of course, the science and the technology are very easily translated across national and jurisdictional boundaries, but that really is an argument for the governance of breeding according to purposes. It should be consistent with the purpose of securing safe, just and sustainable food and farming systems. A technology can be applied in any number of contexts, and one cannot necessarily control them all. However, if you set out in the right direction, you have a much better chance of arriving at a desirable destination.

Dr Campbell: Chair, may I comment on that?

The Chair: Yes, you can. The question was not directed to you—again, I am mindful of time—but of course, please do come in.

Dr Campbell: I will be very brief. I just wanted to pick up on one thing said by Mr Stevenson and one by Dr Mills. Mr Stevenson mentioned the scope of the animal welfare advisory body as it is written into the Bill, and I think he is absolutely right. It needs to be increased so that it has a more proactive function and looks at the actual process of precision breeding, not just looking at marketing authorisation applications. I know you talked before I joined the meeting about the interaction between the ASPA and this piece of legislation. I think it is going to be very important to understand that and whether the Bill is proposing to bring some genetic precision breeding out of the ASPA and into a non-ASPA realm. The advisory body will be important there.

That brings me on to the point about the international aspects of this legislation. I am very aware that one can go online now, already, and buy a genetic editing kit for frogs, including live frogs. You have to purchase it in the States—I checked this morning before I joined. We must be careful of having a system in place that carefully regulates professional scientists, but somehow allows others to undertake genetic editing of animals outside of it. That will be very important to protect animal welfare, as well.

Q171 Katherine Fletcher (South Ribble) (Con): I am a huge supporter of higher welfare standards for animals—it is really vital. Having lived and worked in Africa, I agree with Dr Mills that we are fortunate in the UK to value the fellow mammals that we share the planet with—we can forgive the odd chicken and not get offended. However, to my mind, the Bill is about enabling science and making sure that we can go forward and use the tools and techniques in institutes such as Roslin. I am not sure why animal welfare would need to go in the Bill if precision breeding is the same as traditional breeding and, in fact, lots of the deficits in traditional breeding techniques are what has produced some of the deleterious conditions that current stock animals find themselves in. I will start with Dr Campbell, but I would welcome anyone else coming in. Dr Campbell, in your practice as a vet, if you identify poor animal welfare, what current legislation would you be using to ensure that that was taken up and prevented? I do not see the link between a different breeding technique and animal welfare standards falling over. Do you see what I am getting at?

Dr Campbell: I think I see what you are getting at. Obviously, in normal, non-experimental areas, one would be looking either at the Animal Welfare Act 2006 or at the Veterinary Surgeons Act 1966. I think what is different here is the potential for off-target effects, which at the moment are not very well understood and not predictable. We need to have a mechanism for keeping a very close eye on those.

I have one more point. There is—carried over from the consultation on this Bill, I think—an idea that a mutation, effectively, that could occur in the wild is really no different from what we are trying to achieve by genetic editing. And while it is true that a mutation might occur in the wild, that does not necessarily mean that it is not a bad thing. And anyway, when we are

doing the genetic editing, we are very deliberately trying to cause something at a very high incidence, and that probably would not be the incidence of the mutation in the wild. So I do think there is a difference between employing these technologies and just more general selective breeding, and so-called traditional breeding is currently ill defined in this Bill.

Q172 Katherine Fletcher: There are a couple of points there. Could I just come back to the question that I asked, which was about having animal welfare standards in this Bill, because for me the Bill is about enabling science? Then I would like to ask a brief follow-up question on your point about the techniques.

The Chair: Be mindful that we have under three minutes left of the whole sitting.

Katherine Fletcher: Okay, I will ask this in one sentence. Current animal welfare standards are not in this Bill, but we have animal welfare standards—is that right?

Dr Campbell: We have animal welfare standards under the Animal Welfare Act 2006, certainly. A noticeable thing about this Bill—I think someone else mentioned the Animal Welfare (Sentience) Act 2022—is that, as I understand it, the Bill is relying on the definition of animal in the Animal Welfare Act and that of course is less comprehensive than the definition in this year's Animal Welfare (Sentience) Act. It does not include cephalopods or decapods, and I am unclear on why that is.

Katherine Fletcher: In the interests of time, perhaps we can pick this back up and explore it later. I am conscious that others want to come in, Ms McVey.

The Chair: Okay, with two minutes left, is it possible to get Kerry McCarthy and Andrew Bowie in?

Q173 Kerry McCarthy: This will possibly have a one-word answer. We have heard quite a few witnesses say that the farm animal welfare codes are sufficient in terms of regulating some of our concerns bout welfare. This question is particularly for Professor Campbell and Mr Stevenson. Do you think they are adequate?

Peter Stevenson: No, the codes do not address breeding issues in any very clear way, other than sometimes through a broad principle to say, "Yes, be careful how you breed in order not to harm animal welfare." We have a huge amount of legislation in this country, but just one or perhaps two provisions that deal with breeding, and they are so broadly worded that they have never had any impact on the harms done by selective breeding. To go back to Katherine Fletcher's point, I think it is vital that there is something in this Bill to protect animal welfare, because the current legislation, as I said, has really very little on breeding, which is why we have all these problems. If this Bill is going ahead—I know it is—let us at least have some good, well-crafted animal welfare protections.

Katherine Fletcher: Is not the implication of that that you would be telling the scientists what to do?

The Chair: Sorry, but we have only 30 seconds left. Can you do a quick question, Andrew Bowie?

Andrew Bowie (West Aberdeenshire and Kincardine) (Con): Yes; this is just to Peter Stevenson. We all agree that intensive farming and seeing animals held in situations that we would not have in this country engender disease and all the rest of it. We see that around the world. Is not it better that we use the technology and science being developed in the UK, at places such as Roslin, to try to edit out those diseases, because practically, these animals are being held in conditions that would not be acceptable in this country? We can export that technology overseas.

The Chair: Order. I am afraid that brings us to the end of the time allotted for this sitting, but I want to say thank you very much indeed to Dr Peter Mills, Dr Madeleine Campbell and Peter Stevenson for being with us here today.

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

1.5 pm

Adjourned till this day at Two o'clock.