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Parliamentary Under Secretary
Department for Environment and Rural Affairs
Nobel House
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11 April 2012

Dear Lord Taylor,

Cloning of Farm Animals

Further to your letter of 27th December last year about the Commission's report on animal cloning for food production, I should like to update you about cloning and its impact on farm animal welfare. I anticipate that FAWC will publish its Opinion on the Welfare Implications of Breeding and Breeding Technologies in Commercial Livestock Agriculture later this year.

Evidence about cloning farm animals

Information about cloning was published by the European Food Safety Authority (EFSA) in 2009¹ and 2010², as updates to their major report in 2008³. The National Standing Committee on Farm Animal Genetic Resources (FAnGR) also published a statement about cloning in 2010⁴. In drafting this letter, FAWC has sought independent information from scientists involved in the field of cloning and related areas. Little has changed since FAWC's previous advice in January 2007⁵: caution is required if farm animal welfare is to be promoted.

Cloning involves somatic cell nuclear transfer (SCNT), whereby a genetic copy of an animal is produced by replacing the nucleus of an unfertilised egg cell with the nucleus of a somatic cell to form an embryo. This is then transferred to a surrogate dam where it develops until birth. Essentially, cloning replicates the genetic make-up of the animal from which the cell nucleus was taken to produce the cloned offspring. It is distinct from genetic modification, which alters animal characteristics by directly changing the DNA sequence. SCNT is a relatively new technology in animal reproduction, with limited information available; it is used in some countries to produce clones, which can then be used for further breeding using conventional or other methods.

Cloning is routinely used in plants where it has a number of benefits such as resistance to disease. For animals, there are generally three main applications of cloning besides funda-

¹ European Food Safety Authority 2009. Statement of EFSA prepared by the Scientific Committee and Advisory Forum Unit on Further Advice on the Implications of Animal Cloning (SCNT). The EFSA Journal, 319, 1-15

² European Food Safety Authority 2010. Update on the state of play of animal cloning. The EFSA Journal 8, 1784.

³ European Food Safety Authority 2008. Food Safety, Animal Health and Welfare and Environmental Impact of Animals derived from Cloning by Somatic Cell Nucleus Transfer (SCNT) and their offspring and Products Obtained from those Animals. The EFSA Journal, 767, 1-49

⁴ <http://archive.defra.gov.uk/fangr/documents/100914-cloning-statement.pdf>

⁵ <http://www.fawc.org.uk/pdf/250107.pdf>

mental research, i.e. i) production of elite breeding animals; ii) reproduction of transgenic animals (largely for biomedical purposes); and iii) preservation of rare animals and breeds, and genetic diversity.

Any potential or actual benefits of cloning for farm animal production should be weighed against the potential or actual harms.

Impact on farm animal welfare

Cloning is not currently carried out in the UK, except for the purpose of research, so the impact of cloning on the welfare of commercially farmed animals is not a current issue. In reviewing the (somewhat sparse) literature, EFSA made the following observations:

1. For surrogate dams used for cloning, there are more failures during pregnancy in cattle and pigs and dystocia, especially in cattle. One study reported abnormal umbilical cord formations in around 14% of cloned piglets, amongst other foetal abnormalities, although these problems have not always been observed in other studies.

2. Foetal oversize (a.k.a. large offspring syndrome) has been reported, making caesarean sections more common in cattle carrying a clone than with conventional pregnancies. These effects have also been observed in surrogate dams carrying pregnancies induced by assisted reproductive technologies not involving SCNT, but at a lower frequency. The reasons likely involve epigenetic programming, where extra information is inherited alongside DNA during the reproductive process that requires certain conditions for their effects to be either switched on or off. It is believed that the lack of optimal conditions *in vitro* contributes to these problems. If the success rate of epigenetic reprogramming improves, it is likely that the pathologies and mortalities observed in a proportion of clones would decrease. Indeed, some claim that the efficiency of cloning (in pigs) has become very much greater. As some of this work has been undertaken by private companies, it is unlikely that the findings will be published because of commercial sensitivities.

3. A significant proportion of clones are adversely affected, often severely and fatally, mainly within the juvenile period for bovines and perinatal period for pigs. There are reports of delayed maturation of skeletal muscle during their first year in calf clones. However, most clones that survive the perinatal period are normal and healthy. Clones and their progeny have not yet been studied throughout the whole of their natural lifespan, probably because of the large cost of doing so; most research has focussed on embryonic and early development. Although at least 22 animal species have now been cloned, there is a dearth of information on the lifetime effects of cloning, especially for livestock species other than pigs or cattle.

Cloning *per se* does not usually affect the welfare of animals from which the somatic cell nucleus and oocyte are obtained, unless ovum pickup is used in which case the welfare impact of the operations involved needs to be monitored.

Efficiency of cloning

The percentage of embryo clones transferred into surrogate dams that survive to adulthood in cattle is around 10% and around 6% in pigs. This is a lower efficiency than for natural mating and artificial insemination, but similar to embryo transfer.

Trade and food safety issues

Cloning is not carried out commercially in the UK, and elsewhere in Europe, other than for the purposes of research under the regulations of the Home Office (and equivalent bodies in

Europe). Commercial cloning is common in the USA, Argentina and Brazil, amongst others. In these countries, there are no regulations restricting export of clones, their offspring, semen or embryos, or products derived from clones or their offspring, and there is no requirement to label such animals or products. Since there is currently no way of differentiating animals or animal products derived from a clone or the offspring of a clone from 'uncloned' animals or their products, it is impossible to ensure full traceability. Farmers in the UK can purchase semen or livestock from abroad without knowledge of whether the animal itself was cloned. This possibility is also true for semen from animals that were born as a result of embryo transfer, which is lawful for commercial livestock in the UK. Consumer choice would be easier if 'cloned' products were labelled.

EU legislation regards foods and food ingredients derived from clones as novel; approval is needed at EU level before they can be placed on the market. Trade in cloned animals or semen, ova, embryos or offspring from clones is not banned in the EU.

The Commission advises that EU novel foods legislation does not apply to the offspring of clones, as there is no indication that there are differences in terms of food safety between food products from healthy cattle and pig clones and their progeny, compared with those from (healthy) conventionally-bred animals. The FSA advise that the same legislation should apply to the offspring of clones. FAnGR states there is no scientific reason for treating the healthy offspring of clones any differently from other animals with regard to the production of food.

Conclusions

The welfare implications of cloning farm animals are: i) cloning *per se* does not usually affect the welfare of animals from which the somatic cell nucleus and oocyte are obtained, unless ovum pickup is used; ii) late gestational losses, dystocia and large offspring in SCNT are likely to compromise the welfare of surrogate dams carrying calf clones; iii) due to the low efficiency of cloning *per se*, a high number of surrogate dams suffer pregnancy failure; and iv) the welfare of a significant proportion of the clones themselves is adversely affected.

I should be more than willing to amplify any of these points.

Yours sincerely



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Chairman, Farm Animal Welfare Committee

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