



**FAWC Report on the Welfare Implications
of Animal Breeding and Breeding
Technologies in Commercial Agriculture**

June 2004

**Farm Animal Welfare Council
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FOREWORD

This FAWC report addresses activities associated with breeding of farm animals, an area of concern which has been identified by Government advisory groups, including FAWC and others, over many years. In it we have attempted to achieve a realistic balance between the needs of the animals involved in modern agriculture, and the needs of producers in the highly competitive, global markets which they face. We have also identified the benefits that can result from selective breeding and new breeding technologies as well as the threats they may present.

The issues we have identified are of great public interest. Few, if any, of them have simple solutions, and decisions will need to be made on a case by case basis over periods which may extend to several years. Some practices may require long term monitoring for adverse effects.

It is for these reasons that we have determined the need for a Standing Committee to provide advice for Government and for the industry on the complex matters that relate to animal breeding and associated technologies. We have proposed that this Committee should be created within the ambit of FAWC and have identified the additional resources that will be required to take on this important task.

We have been fully conscious of the potential costs of our recommendations from the outset, and we have sought solutions that are proportionate to the potential risks and benefits. We have also examined those risks of not taking action at this time and have consulted fully both with producers, welfare groups and other stakeholders, in reaching our conclusions. We believe our recommendations have wide support amongst stakeholders on all sides.

I commend this report to Ministers and sincerely hope that the wisdom of its arguments and recommendations will receive their wholehearted support.



Judy MacArthur Clark
June 2004

SUMMARY OF RECOMMENDATIONS

Recommendation 1

FAWC recommends that a Standing Committee be established for the evaluation of new and existing breeding technologies as well as for the consideration of welfare and ethical problems arising as a result of livestock breeding programmes.

Recommendation 2

FAWC recommends that the Standing Committee provide advice to Government on the effectiveness of existing legislation, and the possible gaps that exist, relating to farm animal breeding procedures, in order to promote animal welfare.

Recommendation 3

FAWC recommends that the Standing Committee give due consideration to ethical questions associated with animal breeding even where measurable detrimental effects on animal welfare may not be immediately evident.

Recommendation 4

FAWC recommends that any breeding technology, whether developed within the UK or overseas, be thoroughly evaluated by the Standing Committee prior to, and during, its incorporation into commercial agricultural practice in the UK.

Recommendation 5

FAWC recommends that targeted surveillance is made of farms where new breed types or new breeding technologies are first introduced into commercial practice, and that the welfare impact of all such developments is reviewed throughout a period of normally not less than 5 years after introduction into commercial agriculture.

Recommendation 6

In order to determine the consequences of current breeding strategies or any new breeding technology and to provide essential feedback on welfare performance for breed companies, FAWC recommends that a robust surveillance system be established. This should accurately monitor the incidence of specified on-farm welfare problems and be capable of providing information on welfare problems associated with breeding strategies or technologies and to determine the respective genetic and environmental contributions. This surveillance system should include extensive data currently collected, for example, by breed societies and breed companies, and should be developed in association with, and as part of, the Government's Animal Health and Welfare and Veterinary Surveillance Strategies.

Recommendation 7

FAWC recommends that the Government consider methods to close potential loopholes that would allow GM or cloned animals, their gametes or embryos, to enter UK commercial agriculture uncontrolled.

Recommendation 8

FAWC recommends that industry, possibly with Government support, should sponsor research and training programmes for the development of husbandry systems to support the demands of new genotypes in relation to their production system.

PART I: INTRODUCTION

1. The Farm Animal Welfare Council (FAWC) was established in 1979. Its terms of reference are to keep under review the welfare of farm animals on agricultural land, at market, in transit and at the place of slaughter; and to advise Great Britain's Rural Affairs Ministers of any legislative or other changes that may be necessary. The Council has the freedom to consider any topic falling within this remit.
2. The aim of this report is to provide clear and practical advice to Government on the establishment of an appropriate framework within which developments in animal breeding and breeding technologies, and the outcome of such processes, may be considered, monitored and, where necessary, regulated. FAWC, and a number of other bodies, have been addressing this issue for some time, the result of which for FAWC is this report. The publication of the Agriculture and Environment Biotechnology Commission's (AEBC) report on Animals and Biotechnology (2002) prompted Government to invite FAWC to establish a joint working party with members of the Companion Animal Welfare Council (CAWC), the Animal Procedures Committee (APC) and a representative from the Department for International Development (DfID) to give further detailed consideration to the AEBC's recommendations. Whilst FAWC intends to respond to the AEBC's recommendations in a separate document, the welfare concerns and recommendations in this report are directly relevant to many areas covered by the AEBC report.
3. The commercial applications of new breeding technologies, as well as conventional breeding strategies, have the potential to influence animal welfare in a positive way. For example, in FAWC's *Report on the Welfare of Dairy Cattle (1997)* we recommended that, when commercially available, the sexing of sperm should be used to reduce the number of unwanted male dairy calves, provided that the technique had not been shown to produce adverse effects. Other potential 'positive' applications include breeding for longevity in dairy cows, improved neonatal survival in pigs and breeding for anatomical characteristics to reduce the risk of fly strike in sheep. Breeding for disease resistance in a range of species is also attracting increasing research interest.
4. On the other hand, inappropriate use of breeding technologies may create new problems, or exacerbate welfare problems that may already have arisen within conventional livestock breeding. We have previously expressed concern that some of the serious welfare problems in commercial agriculture are the outcome of a lack of balance in genetic selection in conventional livestock breeding programmes. To highlight this, a summary of concerns and recommendations from previous FAWC reports is contained in Appendix A.
5. It is the impact of any breeding technology or strategy that is important to welfare, whether it is the quality of life of the offspring that is compromised, or whether it is the application of the technology itself that affects welfare. Furthermore, where genotype associated welfare problems are recognised, FAWC believes there is no reason to separate commercial applications of new breeding technologies from conventional livestock breeding. Indeed, the boundaries between conventional breeding and biotechnology have become increasingly blurred, particularly as a result of developments such as marker assisted

selection which can allow faster genetic change in target traits than through conventional livestock breeding methods. Such developments should not necessarily be viewed as a threat to animal welfare. If they are applied to animal breeding in a responsible way, they have the potential to improve welfare.

6. Whilst FAWC is satisfied that the scientific development of breeding technologies developed within the UK is adequately controlled when under the Animals (Scientific Procedures) Act (A(SP)A), we believe that additional safeguards are required with regard to the suitability for their introduction into commercial agriculture. Additional safeguards are also required for the importation of new breeding technologies developed elsewhere, and for the importation of certain breeds of livestock, whether they are the product of new breeding technologies or the result of conventional breeding.

7. We are also of the opinion that there should be a proper assessment of welfare, not only for novel or existing technologies, whether imported or developed within the UK, but also for conventional breeding programmes. Given the concerns listed in appendix A, it may be seen that, in welfare terms, it is within the area of conventional breeding that some serious and extensive farm animal welfare problems are currently found in commercial agriculture.

8. This is a view supported by The Federation of Veterinarians of Europe (FVE) who considered these issues and in 1999 adopted a resolution urging, "member countries and the European Commission to consider the introduction of measures designed to safeguard the welfare of animals with respect to the risks inherent in selective breeding programmes, while preserving the unique characteristics and genetic advantages of European breeds".

9. In the production of this report we have used selected examples of welfare problems to illustrate the breadth of welfare issues associated with breeding and breeding technologies. More extensive reviews of techniques, recent developments in biotechnology, and the ethical and welfare issues associated with modern animal breeding may be found in reports by the Agriculture and Environment Biotechnology Commission (AEBC) (*Animals and Biotechnology, 2002*), the Animal Procedures Committee (*Report on Biotechnology, 2001*), the Royal Society (*The Use of Genetically Modified Animals, 2000*), FAWC (*Report on the Implications of Cloning for the Welfare of Farmed Livestock, 1998*), and the Banner Committee (*Report of the Committee to Consider the Ethical Implications of Emerging Technologies in the Breeding of Farm Animals, 1995*).

FAWC'S philosophy and methods

10. Animals are kept for various purposes and in return their needs should be provided for. They are recognised as sentient beings in the Treaty of Amsterdam, thus FAWC considers that we have a moral obligation to each individual animal that we use. This obligation includes never causing certain serious harm to animals and, when deciding on our actions, endeavouring to balance any other harms against benefits to humans and/or other animals.

11. The achievement of high standards of animal welfare requires awareness of animal

needs and both caring and careful efforts on the part of all that are involved in the supervision of farmed animals. General guidelines as to what those who use animals should provide in order to avoid suffering and other harms, are contained in the five freedoms:

Freedom from hunger and thirst, by ready access to fresh water and a diet to maintain full health and vigour;

Freedom from discomfort, by providing an appropriate environment including shelter and a comfortable resting area;

Freedom from pain, injury and disease, by prevention or rapid diagnosis and treatment;

Freedom to express normal behaviour, by providing sufficient space, proper facilities and company of the animal's own kind;

Freedom from fear and distress, by ensuring conditions and treatment which avoid mental suffering.

12. When assessing any welfare problem, it is necessary to consider both the extent of poor welfare and its duration. Welfare assessment concerns individual animals. However, where there are indications of poor welfare, we consider that the more animals which are affected, the more serious is the problem.

13. In order to offer useful advice about the welfare of farm animals, FAWC takes account of scientific knowledge and the practical experience of those involved in the agriculture industry. A broad-ranging approach, taking into account all relevant views and attempting to balance human benefit with a concern to ensure that the animal's interest remains to the fore, is used in the formulation of FAWC recommendations.

14. Knowledge based on scientific studies of the welfare of animals is increasing rapidly. The term 'animal welfare' is employed frequently in scientific and legal documents and in public statements. In our view, welfare encompasses the animal's health and general physical condition, its mental state, its biological fitness and its ability to cope with any adverse effects of the environment in which it is kept.

Background

15. FAWC first considered welfare issues associated with animal breeding in 1991 when we expressed concern that breeding had altered the shape of Belgian Blue cattle such that they were unable to reproduce naturally without an unacceptable degree of pain, and that a large proportion of calvings required a caesarean section for the calves to be delivered.

16. We discussed the welfare implications of breeding technologies in 1993, when giving evidence to the Banner Committee, which had been established to consider and report on the ethical implications of emerging technologies in the breeding of farm animals. One of the main points FAWC made to the Committee was that we regarded the Animals (Scientific Procedures) Act 1986 (A(SP)A) as a sound Act, particularly because the principle of cost benefit analysis was applied to proposals, thereby assessing the extent of suffering to animals against the potential benefit to society and to other animals. We thought that it had

improved the attitude of researchers towards experimental animals by requiring them to demonstrate to the Home Office the integrity of the work and that there would be benefits from it. At the time, FAWC expressed concern that no comparable legislation existed to protect animals once they left the Act and entered commercial farming practice. FAWC suggested that on release from A(SP)A, a technique needed to be in the public domain, needed to be monitored for 4-5 years and then reviewed in the light of comprehensive field studies.

17. FAWC argued that the application of any new technology should be defined, not only by method, but also by consequence. We proposed to the Banner Committee that an independent body should be established which would deal with specific procedures by reviewing the welfare costs and benefits of their commercial application. We suggested that such a body need not be overly restrictive and that it would also help alleviate any public disquiet about such technologies by demonstrating that they had been properly considered.

18. We welcomed the publication in 1995 of the report by the Banner Committee. It provided an excellent overview of developments in biotechnology and produced a number of recommendations, which FAWC supported. The committee agreed with FAWC that there was a need for an independent body to rigorously address the ethical questions that future developments would pose. A key recommendation of the Banner Committee was that a standing committee for this purpose should be established.

19. The Banner Committee also commented that although normal selective breeding fell outside of its remit, that it was not invariably neutral as regards animal welfare, and could result in "highly objectionable side effects".

20. In 1998, FAWC published its *Report on the Implications of Cloning for the Welfare of Farmed Livestock*. We recommended that the general principles as prescribed by the Banner Committee should be adopted as a framework within which present and future uses of animals should be assessed. FAWC also made a series of recommendations specific to cloning technology. A central recommendation was that a National Standing Committee should be established to oversee developments in cloning technology (see Appendix A).

21. More recently, FAWC gave evidence to the AEBC during their work towards their report *Animals and Biotechnology (2002)*. The report makes an important contribution to the debate on biotechnology, particularly since it has also sought to include public opinion in the development of its conclusions. FAWC has responded to the AEBC report in a separate document, and we support AEBC's main recommendations. In particular, the AEBC report recommended that "a new strategic advisory body should be set up to examine issues raised by the use of genetic biotechnology on farm animals in the context of its use on other animals and current livestock farming practices".

PART II: REGULATIONS

Current animal welfare regulations and codes relevant to breeding and breeding technologies

(i) General welfare provisions

22. The overarching legislation covering animal welfare in England and Wales is the Protection of Animals Act 1911. In Scotland, the Protection of Animals Act (Scotland) 1912 applies. These Acts contain the general law relating to cruelty to animals. Broadly, it is an offence to cause any unnecessary suffering to any domestic or captive animal by anything that is done or omitted to be done.

23. The Government is in the process of consolidating and modernising animal welfare legislation including the Protection of Animals Act 1911. FAWC understands that a major aim of this exercise is to promote, within the revised legislation, the ideas of good welfare standards and the promotion of proactive measures to ensure that animals do not suffer. It is expected that Scotland will introduce similar revisions to its animal welfare legislation. FAWC welcomes this revision of the legislation in all the administrations.

24. The Agriculture (Miscellaneous Provisions) Act 1968, Part I, is the primary piece of legislation applicable specifically to farm animals. The Act makes it an offence to cause or permit livestock on agricultural land to suffer unnecessary pain or unnecessary distress. The Act empowers Ministers, subject to Parliamentary approval, to make mandatory regulations and to issue Codes of Recommendations for the welfare of livestock. They are also empowered to prohibit certain operations on animals.

25. Legislation made under the Agriculture (Miscellaneous Provisions) Act includes The Welfare of Farmed Animals (England) Regulations 2000 and the equivalent regulations in Scotland (2000) and Wales (2001) which contain the general conditions under which all farmed animals must be kept. Many elements of these Regulations implement European Directives on farm animal welfare. For example, an amendment to the Regulations was introduced in 2002 to include the requirements of an updated European Directive applicable to laying hens. Most farm animal welfare legislation is now being set by the European Union for implementation by all Member States.

26. The Department for Environment, Food and Rural Affairs (Defra) produces Codes of Recommendations for all those species specified under the Regulations. These Welfare Codes contain guidance to encourage those who care for farm animals to adopt acceptable standards of husbandry. They also set out the important legal requirements.

(ii) EU legislation on farm animal breeding procedures

27. Specific legislation on farm animal breeding procedures is now in force as a result of European Directive 98/58/EC concerning the protection of animals for farming purposes. This is implemented in The Welfare of Farmed Animals (England) Regulations 2000, and the equivalent Regulations for the devolved administrations, which state that: “natural or artificial breeding procedures which cause, or are likely to cause, suffering or injury to any of the animals concerned shall not be practised”, and that: “no animal shall be kept for farming purposes unless it can reasonably be expected, on the basis of their genotype or phenotype, that they can be kept without detrimental effect on their health and welfare.”

(iii) Domestic legislation specific to the development of novel breeding technologies

28. The process of developing any new breeding technology within the UK is covered by The Animals (Scientific Procedures) Act 1986 (A(SP)A), which is administered by the Home Office in England, Scotland and Wales. This Act is for the protection of animals used for experimental or other scientific purposes. Animals covered under the Act are all non-human vertebrates, including larval or embryonic forms that have reached a certain stage in development. The Act also covers one invertebrate species (*Octopus vulgaris*). The Act covers work on Genetically Modified (GM) animals and also cloned animals.

29. Under the Act, any scientific procedure which may cause pain, suffering, distress or lasting harm is judged to be a regulated procedure. In the case of GM animals, both the initial production as well as any subsequent breeding of the animal is considered a regulated procedure. The legislation applies until the death of the animal and applies to its offspring, should there be any, until their death. Second generation offspring from these animals may be considered for discharge from the Act following submission of acceptable welfare records covering the full natural lifespan of the animal.

30. FAWC is satisfied that the regulations are strictly enforced and that animals would not be released if there was any evidence that welfare might be compromised. At the time of writing this report FAWC is not aware that any applications have been received for discharge of GM animals from A(SP)A.

31. There is additional EU legislation covering the development, placing on the market, traceability and labelling and transboundary movements of all Genetically Modified Organisms (GMO's) which adopts a step by step process for their assessment. Initially, genetic modification is carried out in containment. This is governed by EC Directive 90/219 (as amended by Directive 98/81/EC) and is closely controlled by the Health and Safety Executive. This Directive is implemented in the UK by way of the Genetically Modified Organisms (Contained Use) Regulations 2000, the GMO (Risk Assessment) (Records and Exemptions) Regulations 1996 (as amended) and the Environmental Protection Act 1990.

32. The deliberate release and placing on the market of GMOs, including animals, is governed by European Directive 2001/18 EC. In Great Britain this has been implemented by way of Part VI of the Environmental Protection Act 1990 and, in England, the Genetically Modified Organisms (Deliberate Release) Regulations 2002 (equivalent

regulations have been implemented in the devolved administrations). Decisions on whether or not to allow a release are based on a detailed assessment of any risks that may be posed by the GMO to human health or the environment on a case-by-case basis. This would also include assessment of any risks to animal health, although not specifically welfare. Directive 2001/18 also includes requirements for labelling of GM products. This Directive has been amended by two new EU regulations on traceability and labelling (1830/2003) of GMOs and GM food and feed (1829/2003) which came into force in April of this year. Any application in the future to assess a GM animal for food use would therefore be assessed by the European Food Safety Authority under the new food and feed legislation.

(iv) Other welfare initiatives relevant to animal breeding

33. Within the UK there are examples of initiatives by animal breeders as well as veterinary bodies to address welfare concerns associated with breeding and breeding technologies. For example, the UK dairy industry has developed a nationally available selection index (£Production Lifespan Index (£PLI)) that incorporates longevity, as an inclusive measure of cow health, in addition to production traits. Plans are in place to expand the £PLI to include additional health traits, for example, lameness, that will increase opportunities for dairy farmers to select bulls for both health and production. FAWC is encouraged by these developments.

34. The Sheep Veterinary Society and the British Cattle Veterinary Association (BCVA), amongst others, have both produced guidelines on advanced breeding technologies which recognise welfare concerns to reduce certain breeding associated problems. Such initiatives and Codes of Practice are to be welcomed, and FAWC would encourage all sectors to follow their example. However, their impact on welfare will be determined by the extent to which they are adopted and applied in any given livestock sector.

35. The Royal College of Veterinary Surgeons (RCVS) advises on artificial breeding techniques, including embryo collection and transfer, in its Guide to Professional Conduct (2004). The advice is based upon the Bovine Embryo (Collection, Production and Transfer) Regulations 1995, but through its professional guidance, the RCVS extends the principles to other species and techniques used in advanced breeding technology. It is stressed that, at all stages in such procedures, the welfare of animals should be paramount. Nevertheless, the RCVS has no mechanism to routinely monitor compliance with this advice. Furthermore, this advice is only applicable in techniques where veterinarians are directly involved or are responsible for supervision.

36. The Government and their devolved counterparts, the Scottish Executive (SE) and the Welsh Assembly Government (WAG) have recently published their Animal Health and Welfare Strategy for Great Britain. One of the aims of the strategy is to encourage industry to develop animal health and welfare plans, something which has the potential to impact on animal breeding and breeding technologies significantly (see paragraphs 57 & 91). FAWC welcomes this joint initiative and hopes that both health and welfare will be given equal emphasis.

(v) European Initiatives

37. In response to growing public concern about farm animal breeding and reproduction, the Sustainable European Farm Animal Breeding And Reproduction (SEFABAR) project was initiated in 2000 by the Farm Animal Industrial Platform (FAIP). It was an EU funded Thematic Network of representatives from all sectors of the livestock industry, breeding scientists and economists, brought together in a series of workshops over a three year period. During this time, the remit of SEFABAR was to discuss the future sustainability of livestock breeding within Europe, including a consideration of future European and world markets. Animal, human health and environmental considerations also formed important parts of the discussions.

38. One of the outcomes of the workshops is the agreement by breeding organisations represented within SEFABAR to develop Codes of Practice for farm animal breeding. These codes are now being developed under a new 18-month FAIP co-ordinated project, Code of Good Practice for European Farm Animal Breeding and Reproduction (CODE-EFABAR). A draft of these Codes is expected in September 2004.

39. If welfare is given a high priority within these proposed Codes and European breeding organisations agree to operate within them, they have the potential to raise the prominence of animal welfare as a key issue in changing breeding strategies. However, it must be recognised that many breed organisations operate within world markets and this may constrain the degree to which such Codes may address welfare concerns, particularly those which, in order to enhance welfare, might constrain the ability to achieve the gains that commercial sustainability usually requires.

40. FAWC welcomes the SEFABAR and CODE-EFABAR initiatives and their outcomes to date, in particular, the fact that SEFABAR also considered ethical standards and recognised the importance in animal breeding of selecting for welfare enhancing traits. However, it remains the case that such initiatives are industry led and thus, in that sense, do not satisfy the requirement for independence that was called for in the Banner Committee, AEBC and FAWC cloning reports in their recommendations for a group to consider farm animal breeding issues.

Gaps in current regulations

(i) Concerns about general welfare legislation

41. FAWC recognises the value of the EU legislative requirement specific to animal breeding (paragraph 27) but is concerned about how effectively it is enforced. For example, we are not aware of any cases where it has been used successfully to restrict any breeding procedure. Examples of genotype associated welfare problems in commercial agriculture, such as those documented in the modern dairy cow or broiler chicken, demonstrate the obvious difficulties in defining what is unacceptable in terms of animal welfare. It is also clear that when problems are recognised in species in widespread commercial use, there may

often be no easy solution to rectify them, particularly when they have arisen as a result of past breeding strategies or changes in husbandry and management. Effective advice, and possibly legislative control, is needed to define acceptable and realistic breeding goals if such welfare problems are to be addressed.

42. FAWC has also sought to determine how those sections of European Directive 98/58/EC concerning animal breeding are interpreted and implemented in other parts of Europe. However, we have found no detailed regulatory framework in any Member State which addresses fully the particular problems associated with the breeding of farm livestock for commercial purposes. Member States such as Italy have taken a similar approach to the UK in that the wording of the European Directive has been incorporated into national legislation. Denmark and Sweden have introduced legislation which allows the possibility of future controls. For example, the Danish Act on the Protection of Animals 1991 states that the Minister of Justice may lay down rules prohibiting the release of bred animals which have difficulties living in nature. A further provision gives the Minister of Justice the power to lay down more detailed rules on biotechnology, including a prohibition on the use of such methods on animals kept for farming purposes.

43. German animal welfare law attempts to define more precisely the nature of problems associated with breeding which are considered unacceptable. It is prohibited to breed vertebrates or to change them through biotechnology or genetic engineering if it is expected that the offspring are lacking parts of the body or organs for species specific use or they are unfit or deformed thereby causing pain, suffering or harm. The German legislation specifically mentions behavioural and other welfare problems and prohibits the production of vertebrates where it is expected that behavioural abnormalities will occur resulting in suffering or increased aggressiveness. The law also prohibits breeding vertebrates if their keeping is only possible under conditions causing them pain, avoidable suffering or harm.

44. We conclude that the lack of an adequate framework within the UK for the detailed consideration of how European Directive 98/58/EC may be interpreted and enforced is a significant gap in current welfare controls.

(ii) Concerns about ethical issues associated with animal breeding

45. The AEBC report expressed concern that there is a potential gap in the existing welfare legislation in relation to “the generation of what might be judged intrinsically objectionable changes to animals” even in the absence of clear animal welfare, animal or human health, or environmental concerns, as applicable to both GM and conventional farm animals. The report stated that such “intrinsically objectionable changes” would include insentient animals or animals with their physical characteristics, or normal patterns of behaviour, radically and unacceptably altered. A key recommendation from AEBC was that provision within legislation will be needed to protect animals from such developments.

46. The report of the Banner Committee illustrated the above point with a hypothetical example of a breeding strategy, the aim of which was to produce pigs of reduced sentience and disinclined to engage in activity normal to them. The report stated, “even if this has no

welfare implications (if welfare is understood narrowly as relating to an animal's happiness), so that by any available measure such pigs are as content as any other pigs, still we would maintain that the proposed modification is morally objectionable in treating the animals as raw materials upon which our ends and purposes can be imposed regardless of the ends and purposes which are natural to them. The fact that the project promises an increase in profit, or any other desirable consequence, does not, and cannot, wipe out the intrinsically objectionable character of such an action”.

47. FAWC agrees with both the Banner Committee and with the recommendation of AEBC, that serious consideration must be given to such complex ethical issues (see also paragraphs 104-111).

(iii) Concerns about the importation of animals

48. FAWC is satisfied that the existing controls under A(SP)A, as administered by the Home Office, are adequate to protect the welfare of animals in the laboratory and to control the development of new technologies within the laboratory environment. There is general acceptance, however, that there are potential gaps in control which may allow techniques and animals to be released into commercial agricultural practice unchecked.

49. During our consultation process we were told that no satisfactory regulations are in place to control the importation of GM animals or embryos for commercial agriculture. The Home Office authorises the acquisition and use of a GM animal imported into the UK for scientific purposes (therefore involving A(SP)A) although the actual importation is controlled by Defra. The importation of GM animals and embryos for agricultural purposes are governed by Directive 2001/18, Regulation 1829/2003 and 1830/2003 (see paragraph 32). These regulations require that all GMOs must have relevant authorisation and be appropriately labelled at all stages of placing on the market. In addition, transboundary movements of GM animals from one country to another are also covered by the relevant requirements for safe transfer, handling and use of the Cartagena Protocol on Biosafety. Regulation (EC) No 1946/2003 of the European Parliament and of the Council on transboundary movements of GMOs establishes a common system of notification and information for transboundary movements of GMOs.

50. Despite the controls listed above (and in paragraphs 31 & 32), since the GM status of every animal or consignment of animals entering the country is not currently declared on the paperwork that typically accompanies those animals, although illegal, it would be possible for a GM animal to enter unchecked. That is, since a GM animal does not differ in outward appearance from a non-GM animal, the possibility still exists that the illegal import of GM animals could realistically occur. In addition, even within the law, it is of concern that no specific assessment of an imported GM animal's welfare is required as part of the importation procedure. Given the above, FAWC is concerned that there are potential gaps in the current regulations which would allow GM animals to enter the UK without official knowledge and/or due consideration of their welfare, and we should like the Government to consider how these potential loopholes may be closed.

Recommendation:

51. *FAWC recommends that the Government consider methods to close potential loopholes that would allow GM or cloned animals, their gametes or embryos, to enter UK commercial agriculture uncontrolled.*

(iv) Concerns about the importation of novel breeding technologies

52. A problem in the case of novel technologies is that many are developed from commercial sources, often overseas, and are therefore not initially covered by A(SP)A. Technologies can be introduced from overseas by veterinary surgeons as part of “recognised veterinary practice”. These could become established within livestock farming before there had been any proper evaluation of welfare implications. In the Banner report, ovum pickup was cited as a particular area of concern.

53. This potential problem is also well illustrated by juvenile in vitro embryo transfer (JIVET), a technique currently used commercially in Australia. JIVET is the mechanism through which follicle growth in juvenile animals (calves of 8-10 weeks old and sheep and goats of 6-8 weeks old) can be stimulated, offering the potential to substantially reduce generation intervals and produce multiple progeny. Practically, the technique requires hormone treatment of prepubertal animals, followed by oocyte recovery under general anaesthesia and via laparoscopy. Although this procedure, which presents clear ethical questions and may carry potential welfare problems, is not currently used in UK commercial agriculture, the possibility that this may become the case, as in Australia, is real.

54. Methods of detecting such imports, perhaps through liaison with veterinary practices and organisations, breeding and agricultural representative organisations, and Government departments will be important. In addition, the continued monitoring of imported techniques for an extended period following their introduction is important to ensure that welfare problems which may exist, but which may not be immediately obvious at the time of import, are detected further down the line.

(v) Concerns about domestically developed breeding technologies

55. Even for technologies developed within the UK, once they are outside the protection of A(SP)A, any animal that is subjected to or is the product of new technology is protected only under the general welfare legislation. For example, concern has been expressed to FAWC about the consequences of initiatives to promote the incidence of twin calves in the beef industry through the implantation of multiple embryos. Whilst the technology required to achieve this may not be, in itself, a welfare concern, we are aware that problems, such as poor calf survival and disease have arisen in some commercial agricultural systems.

56. Additional welfare problems may be associated with the implementation of breeding technologies already in existence. For example, there are no rules to govern the number of

embryos which may be implanted into sheep or cattle, or the number of times such a procedure may be performed. Surveillance (both passive and active) by bodies such as the State Veterinary Service, Veterinary Laboratories Agency (VLA) and the Meat Hygiene Service (MHS) may be effective in discovering welfare problems such as these but it is recognised that this is a reactive, rather than a proactive approach. Furthermore, current resources available to such agencies will limit the level of detection achieved.

57. The limitation of resources also makes it impossible to inspect regularly and effectively a sufficient proportion of agricultural holdings. Compared with the situation in research establishments, where every licensed laboratory is subject to at least an annual visit by the Home Office Inspectorate without prior notice, farms might go for many years without any inspection. This is a potential problem for both the detection of novel techniques as well as for the monitoring of welfare problems that might arise in commercial practice. The Veterinary Surveillance and Animal Health and Welfare Strategies currently being developed jointly by Defra, SE and WAG represent a good opportunity to address these problems and improve the effectiveness of the surveillance system, as long as they are adequately resourced.

58. It is essential that targeted surveillance is made of farms where new technologies, developed under laboratory conditions, but recently released into commercial practice, have been implemented. There is a strong argument for a period of commercial trials before novel techniques may be available for general use. This would provide a bridge between the controlled conditions of the laboratory and general farm use. FAWC raised this issue in 1993 when giving evidence to the Banner Committee. We proposed that new techniques needed to be monitored in comprehensive controlled field studies for 4-5 years, and then reviewed in the light of the evidence gathered.

(vi) Concerns about the development of clinical veterinary techniques

59. Veterinary medicines are strictly controlled and cannot be used commercially until evidence of safety, quality and efficacy, as well as any identifiable welfare consequences have been determined. The same is not the case for clinical practices. These can be developed by veterinary clinicians and, in the absence of a formal mechanism to review their efficacy and welfare impact, may be introduced into commercial practice unchecked.

PART III: WELFARE CONSIDERATIONS

Welfare consequences of animal breeding

60. Since 1992, all FAWC reports on the welfare of different species of livestock have highlighted welfare concerns associated directly with animal breeding strategies (see appendix A). However, compared to many other issues which FAWC has addressed, it has been far from straightforward to offer useful advice or to make recommendations as to how such problems may be resolved. The following examples illustrate the range of issues about which we have previously expressed concern and which still need to be addressed.

61. In 1997 (*Report on the Welfare of Dairy Cattle*) FAWC expressed concern that in the modern dairy cow, selection for increased milk yield had compromised welfare, reflected by an increased susceptibility to lameness and mastitis and a reduction in fertility. Subsequent research has supported this conclusion. We recommended that breeding companies should devote their efforts primarily to selection for health traits so as to reduce levels of lameness, mastitis, and infertility and that selection for milk yield should follow only once these health issues have been addressed. The report also made the general recommendation that breeding programmes worldwide should have as a major objective the need for good welfare. Selection criteria used should also not lead to the production of animals that require above average levels of management to prevent welfare problems thus providing a degree of safeguard where management is less than optimal

62. The FAWC *Report on the Welfare of Dairy Cattle* also made a number of recommendations specific to welfare concerns associated with breeding technologies such as ovum pick-up, repeated epidural injections for oocyte collection, the effects of repeated administration of superovulatory drugs, and the problems regarding oversized calves, and hence calving difficulties, resulting from in vitro fertilised embryos.

63. FAWC recognises that multi-trait breeding uses complex mathematics to arrive at an economic optimum for the selection pressure applied to individual traits, and therefore that the above recommendations may lead to the selection of animals that are not performing at the commercial optimum, thus creating a difficulty for breeding companies. In addition, it is recognised that since current breeding indices (see paragraph 33) are at best holding steady on health traits, it may be difficult to reverse problems which have already emerged.

64. The example of the dairy cow demonstrates the need for a broad strategic approach to addressing welfare problems associated with genotype. Such an approach must, of necessity, involve the co-operation of breed companies, farmers, geneticists, veterinary and other advisory organisations (see paragraph 33-36). There is an argument that if real welfare improvements are to be made, there is a need for some level of independent advice, and possibly regulation, on the genotypes that are being promoted within commercial agriculture.

65. Welfare problems associated with conventional breeding methods are also demonstrated in the modern broiler chicken where there is evidence to link past selection for

fast growth with associated leg and cardio-pulmonary problems. The FAWC *Report on the Welfare of Broiler Chickens (1992)* raised particular concerns about the level of leg problems and proposed four principle methods of reducing the incidence, including the increased selection of breeding stock for strong and well-formed legs. Recognition of such problems has encouraged broiler breeding companies to modify selection programmes. However, there is a need for assurance that these changes have had positive effects on animal welfare.

66. FAWC also commented on the selection of broiler breeding stock in its *Report on the Welfare of Broiler Breeders (1998)*. We emphasised the importance of ensuring that factors such as cardio-vascular health, foot and leg health, social behaviour and resistance to disease were given high priority in selection procedures. We also expressed concern at the problem of hunger in broiler breeders and recognised that it was likely to get worse if selection for fast growth continued. We made the specific recommendation that the objectives of the breeding companies in the future development of strains of broilers should include welfare improvement, in particular the avoidance of problems of prolonged hunger in broiler breeders.

67. The resolution adopted in 1999 by the FVE summarised their concerns associated with animal breeding. They stated that “Selective breeding programmes may cause animal welfare problems. It may become difficult or impossible for natural copulation or parturition to occur; offspring produced by selective breeding for certain specific characteristics may be unable to express their natural behaviour; or they may be predisposed to hereditary, congenital, metabolic or infectious disease, disability or early death. The introduction of such selective breeding programmes may make it impossible for the breed to be maintained by natural means“.

68. On the subject of breeding technologies, the FVE stated that, "the use of new and emerging technologies in artificial breeding, such as ovum and embryo transplantation and genetic manipulation, may also be a source of concern, and it is likely that some future advances in science will also have animal welfare implications. The technique used may carry inherent welfare risks for the animal (e.g. the particular method by which semen or ova are obtained); the intended outcome of the procedure may be intrinsically objectionable (e.g. the development of animals with unnatural physical or behavioural characteristics); and offspring may be produced with welfare disadvantages such as those mentioned above".

69. A recent report published by the Department of Trade and Industry (DTI), ‘Genetics and Genomics of Sheep and Cattle in Australia and New Zealand’ effectively highlights the “technological crossroads” that animal breeding has reached. The report emphasises that, “new opportunities are opening up that are likely to transform the way breeders improve their stock”, for example, growing commercial interest in the potential of marker assisted selection looks set to accelerate the rate of genetic change to livestock by conventional selection methods. FAWC recognises that the application of gene-mapping to selective breeding programmes may be used to rectify recognised welfare problems, for example, by selecting for specific health traits such as improved leg health in broilers. We are concerned, however, that with the considerable commercial competition between breed companies, the primary focus of attention will be for production-related traits. In the case of the dairy cow

this might be for higher milk volume and changes in constituents, and for the broiler chicken, faster growth rate, improved feed conversion ratio, or greater breast muscle mass.

70. We are aware of research groups using marker-assisted selection for animals with greater levels of disease resistance, for example, salmonella resistance in poultry and parasite resistance in sheep. The Dti report also states that in Australia and New Zealand, “there [is] considerable interest from a number of groups to identify and exploit genetic variation among livestock for disease resistance”. Whilst this will have obvious welfare benefits, it is important that the development of such strains is not used to disguise welfare threatening conditions which would otherwise produce disease and does not discourage the development of higher standards of stockmanship and provision of a good quality environment.

Genotype and environment interactions

71. The selected examples of welfare problems described in the previous section are those where narrow breeding objectives, or novel breeding technologies have had adverse consequences for animal health and welfare. However, breeding related welfare problems cannot be viewed in isolation since most are inextricably linked with the environment in which animals are kept. Of fundamental importance is the quality of management of any animal throughout its life, but there are many other aspects of the environment which, if inappropriate for a particular genotype, may have consequences for welfare which are just as serious as poor management. For example, welfare problems may arise where a particular breed of animal is poorly suited to the environment in which it is reared. FAWC has raised concerns about this in a number of recent reports.

72. In the *Report on the Welfare of Sheep (1994)* we expressed our concern about the potential problems associated with changes in breed structure in response to the commercial demand for different carcass conformation characteristics. We recommended that if any change in breed or breed type is contemplated in challenging extensive conditions, replacement must only be with one that is sufficiently well adapted to the environment. We also recommended that within breed selection programmes, monitoring is carried out for problems associated with selection for greater muscularity.

73. We made a similar recommendation in our *Report on the Welfare of Pigs Kept Outdoors (1996)* where we stated that, breeding companies, and those responsible for the selection of breeding stock to be kept in outdoor enterprises, should ensure that only those strains of pig with the genetic potential to thrive in the conditions are used. In the report the importance of temperament was also raised and we recommended that when selecting pigs, attention should be paid to the need for good temperament and mothering ability.

74. We hold the general view that the welfare of some breeds of high performance potential may be adversely affected when kept in more extensive or organic environments. The increasing demand for organically produced food has encouraged greater interest in this aspect of animal welfare with some research directed towards the suitability of breed types for organic systems.

75. For example, a recent study has examined the suitability of two commercial broiler strains, one fast- and one slow-growing, in a free range system. Both strains became very heavy at the minimum age of slaughter specified by organic requirements with the fast-growing strain having the poorest feed conversion ratio. This, in addition to poor mobility, as reflected in low usage of the outdoor area, and the presence of deep pectoral myopathies led the authors to suggest that the fast-growing strain was particularly unsuitable for free range production. Given that organic standards require chickens to be slaughtered at a greater age than is now the normal age for standard broiler production, it is likely that exposing certain commercial broiler strains to such systems would be a welfare concern.

76. We have discussed with the Soil Association the potential problems which might arise from unsuitable genotypes in organic farming systems, and are encouraged that they wish to address this matter in future versions of organic farm certification standards. FAWC made a general comment about this matter in the *Interim Report on the Animal Welfare Implications of Farm Assurance Schemes (2001)* where we recommended that consideration be given, in particular, to the incorporation of scheme standards which relate to the breeding and rearing of animals for specific production systems.

77. We believe breed companies should take greater responsibility for this matter and we are concerned that environments in which breeds are developed are often far removed from those in which animals are subsequently reared when in commercial production. With breed companies increasingly operating in global markets, the potential welfare problems resulting from a mismatch between genotype and environment are likely to increase. For example, during consultations for the preparation of this report, concern was expressed about the export of high producing genotypes to situations where, for example, appropriate feeds to meet metabolic demands may not be available.

78. Work on sheep breeding programmes at the Scottish Agriculture College (SAC) has incorporated traits that are important for being a 'good' ewe alongside those important for being a 'good' lamb, in addition to key sustainability traits such as lamb survival and ewe longevity. The new breeding indices developed are intended to improve flock efficiency without detriment to mothering ability and survival characteristics in extensive farming situations. Whilst the researchers recognise that their approach to animal breeding will have particular appeal to organic producers, they also recognise the value of the work to the wider UK hill sheep industry where, in order to offset falling incomes, there has been a trend to increase the number of sheep per shepherd and also a reduction in the amount of veterinary medicines used for disease prevention and treatment.

79. The standard of management is an aspect of the environment in which an animal is kept and we recognise that, with high levels of management, many of the genotypes of higher production potential can often be reared without major welfare concerns. However, FAWC is concerned about the necessity of the high levels of skill required by those persons responsible for some genotypes given the known variation in standards of management across farms.

80. FAWC recognises and welcomes the attempts made by industry to improve the management provided to emerging genotypes, and encourages the maintenance of research and training programmes for the development of these. However, given the potential importance of interactions between specific genotypes and environments on welfare, FAWC would suggest that, in addition, greater consideration of genotype and environment interactions in future breeding programmes is made.

Recommendation:

81. *FAWC recommends that industry, possibly with Government support, should sponsor research and training programmes for the development of husbandry systems to support the demands of new genotypes in relation to their production system.*

Welfare surveillance

82. Since breeding strategies, either by conventional breeding or using novel technologies can have such major influences on animal health and welfare, it is essential to have accurate information on the extent to which any trait which influences welfare is improving or getting worse, in addition to the respective impacts of genetic and environmental factors.

83. Breeding companies test the performance of new genetic strains under highly controlled conditions with very high standards of management, sometimes under the additional control of A(SP)A. It is on release to the commercial sector, when breed company management guidelines are sometimes ignored, standards of husbandry might be lower, or livestock are reared in less than optimal environments, that welfare problems often become apparent.

84. FAWC has discussed with a wide range of interested parties the difficulty of identifying breeding associated welfare problems which may arise. From these discussions it was evident that the lack of accurate on-farm information relating to health and welfare is a serious constraint on improving livestock welfare through breeding programmes.

85. A recent poultry industry survey of lameness in UK broiler chickens demonstrates the possibility of both cooperation and welfare surveillance within this sector of the livestock industry. However, it also demonstrates the potential limited value of such surveillance if those data collected are too restricted. For example, in this instance it remains unclear from the results whether the changes in leg health are the outcome of breeding programmes, or the result of general improvements in standards of husbandry and other environmental factors. This highlights the general situation that, since management and husbandry methods are constantly adjusting to the greater demands of modern genotypes, it may be difficult to determine whether improvements in welfare on the farm are the result of environmental changes rather than a direct effect of changing breeding goals.

86. Reliable monitoring of a range of welfare measures, together with carefully selected production, management and other environmental factors, is required to demonstrate the relative genetic and environmental contributions to altered welfare. If robust data were

collected for all species over an extended period, a dissociation between those factors could be more easily achieved and would be of value to many, including breed companies, researchers and Government departments. For example, robust surveillance data collected prior to and following the withdrawal of meat and bone meal or in-feed antibiotics for poultry production may have aided industry in their evaluation of any reported welfare consequences of such changes.

87. The importance of welfare surveillance to animal breeding strategies has been demonstrated in Scandinavia where, for the last 20 years, integrated databases and comprehensive recording schemes have been developed for both cattle and pig breeding. In the 1970s Scandinavia developed a philosophy that breeding objectives should include health and production traits rather than just production goals. It was recognised that an essential prerequisite for the efficient operation of such breeding objectives was the accurate recording of health, reproduction and production traits. Integrated databases, initially between the milk-recording scheme and the artificial insemination (AI) service, were developed and subsequently expanded to include health traits. For example, in all Scandinavian countries, veterinary reports on clinical treatments are now incorporated into the databases. The result is that Scandinavian countries have adopted Total Merit Indices (TMI) in selection programmes. Not only has such an approach improved animal health, as demonstrated for example, by a steady decline in mastitis levels in dairy cattle, but the total economic gain from selection for a TMI in dairy cattle has been shown to be 10-25% superior to single trait selection, despite a reduced gain in milk production levels.

88. The Scandinavian model has shown the importance of integrated databases and comprehensive recording schemes. The information obtained has provided effective management tools at farm level with economic benefits; it has produced valuable information for research and development at a national level; and it has provided a vehicle for the application of research findings into commercial practice. The cooperative structure of farming in Scandinavia has facilitated the development of such recording systems and FAWC recognises that the different structure of the farming industry within the UK may make the collection and sharing of information more difficult. However, FAWC is encouraged that such difficulties are being addressed and that the breed companies and breed societies have been directly involved in the development and implementation of this.

89. Within the UK, the State Veterinary Service, Local Authorities, and other bodies, monitor compliance with Welfare Codes and legislation. However, welfare surveillance at this level is mainly designed to expose the minority of producers where standards are poor or unacceptable, rather than to provide information about more subtle changes in the prevalence of welfare problems. Simple, workable recording systems for all species covering a range of measures agreed by all interested parties are required to produce robust data with the ability of exposing these subtleties.

90. In some livestock sectors, much of the desired information is already being gathered by, for example, breeding companies. This should be utilised and supported by additional monitoring and surveillance where necessary. However, it is essential that although data may be obtained from a range of sources, their analysis must be carried out by a body which

is considered by all to be independent. In addition, where data is not of a confidential nature this should be made available for further analysis by interested parties.

91. In summary, it is FAWC's view that there is an urgent need to develop for the UK, on-farm welfare surveillance systems, capable of providing reliable, robust information on the prevalence of a range of health and welfare traits for different species of livestock. The information obtained from such surveillance systems would be of value to, and must be available to, farmers, breed companies, veterinarians and researchers. Whilst we recognise that production data will be one element of the data collected, the aim of the surveillance must always be to monitor and improve welfare. The recently published Animal Health and Welfare, and Veterinary Surveillance Strategies (see paragraph 57) are well timed to ensure that this balance is achieved (see recommendations, paragraphs 125 & 126).

Genetic modification

92. This report uses the same definition of genetic modification as that used by The Royal Society in their report, *'The use of genetically modified animals'* (2001). The term 'GM animal' refers to animals modified either via transgenesis (when individual genes from the same or a different species are inserted into another individual) or by the targeting of specific changes in individual genes or chromosomes within a single species.

93. The Royal Society Report (2001) summarised the technical barriers that had to be overcome before the production of GM livestock for food production would be viable, notwithstanding its acceptability to the public. These include; the low efficiency of genetic modification of the genome for pigs, sheep and cattle; the high levels of embryonic loss; the incomplete knowledge of the genome for most of the major farmed species; and the fact that potentially desirable traits such as disease resistance and improved production are polygenic and require the alteration and co-ordinated expression of several genes. The report also noted that funding agencies were not supporting GM livestock projects to a high level since investment returns were considered to be low. They concluded that the commercial development of GM animals as a source of food was unlikely to be progressed unless the regulatory, ethical, economic and environmental issues, as well as public concern can be addressed.

94. The DTI Global Watch Mission report, Genetics and Genomics of Sheep and Cattle in Australia and New Zealand, published in 2003, highlights how this field has developed and expanded since 2001. In contrast to the predictions of the Royal Society, the DTI report states that "over the next 20 years, the number of genes with identified variation relevant to livestock is set to increase dramatically as the knowledge of genes and their functions increases at a phenomenal rate". A key recommendation from this report is that "the UK (industry and Government) should consider significant new investment in molecular genetics of cattle and sheep".

95. The extent to which genetic modification will become incorporated into future livestock breeding strategies may well be determined, not by scientific developments, but by public acceptability of the technology. Opposition to GM crops by consumers, retailers and

environmentalists continues to influence the commercial application of GM technology in the plant sector, and there is no reason to believe that a similar level of opposition would not develop if the technology became incorporated into livestock breeding. Given the above, and also the rapid pace of developments in this area, FAWC recognises the need to remain informed regarding this issue.

Cloning for commercial purposes

96. Although cloning may be used in conjunction with genetic modification technology, it is fundamentally different in that a clone is an organism or cell derived from a single ancestor by asexual means. It was the production in 1997 of a cloned sheep (Dolly) from an adult cell that resulted in considerable public debate on the implications of cloning, particularly the wider ethical issues.

97. In 1998 FAWC produced a *Report on the Implications of Cloning for the Welfare of Farmed Livestock*, which considered the welfare implications of the techniques involved and the regulatory controls which might be necessary.

98. FAWC considered both the ethical and welfare issues associated with cloning and made a number of important recommendations. One overriding recommendation was that, until the problems of oversized offspring, embryonic and foetal losses and birth abnormalities, and the possibility of problems associated with aged DNA, have been satisfactorily resolved, there should be a moratorium on the use of cloning by nuclear transfer in commercial agricultural practice.

99. We also recommended that a National Standing Committee should be established to oversee the developments of cloning technology. It was stated that the Committee should review outputs of research aimed at tackling the welfare problems identified in FAWC's Cloning Report (and any other problems which may emerge); it should determine the time when it may be appropriate to introduce cloning into commercial agricultural practice; and it should ensure that the controls put in place at that time are both adequate and effectively implemented. The report also recommended that the National Standing Committee should play a role in both promoting public awareness of the facts and issues concerning cloning and related technologies, and conveying public concerns to Government and Scientists.

100. The problems associated with cloning identified in FAWC's 1998 report still remain. In all species the efficiency of the technology is still very low: for example in cattle, which is the most studied species, on average only 3% of the transferred cloned embryos develop into viable calves. There are a number of welfare problems associated with nuclear cloning. For example, clones tend to have higher birth weights and may have a greater propensity in later life for respiratory problems and immune system deficiencies compared with normal animals. In addition, placental and foetal abnormalities that can lead to death of the clone at various stages of development are common.

101. In response to FAWC's Cloning Report, Defra supported many of FAWC's recommendations. However, because commercial applications of cloning were still seen as not

of immediate concern, it did not see a need for a moratorium on the commercial use of cloning by nuclear transfer, as proposed by FAWC. However, Defra did not rule out the establishment of a National Standing Committee to oversee the development of cloning technology.

102. It is difficult to predict the extent to which cloning will become incorporated into food animal production in the future. Research has suggested that because of the current technical and welfare problems, there will be few practical applications of cloning in commercial agriculture in the foreseeable future. However, representatives of commercial breeding companies developing cloning for commercial applications see many potential benefits and have predicted that cloning will become a routine part of livestock breeding within 20 years. They suggest that cloning will serve a number of purposes such as the commercial development of disease resistant animals, improved feed conversion, greater muscle mass, and the production of meat of more consistent quality. Breed companies also see an application of cloning to evaluate the performance of animals of the same genetic make-up under different management systems and also in preserving the genome of both premium and rare breeds of animals.

103. At the present time, within the UK, all cloning work including any work on possible commercial applications, is confined to research establishments and is done under the protection of A(SP)A. However, in the light of the predictions made by some commercial breeding companies involved in cloning work, it is essential that FAWC keep a close watching brief on developments in this field.

Ethical considerations

104. FAWC addressed the subject of ethical aspects of biotechnology in the *Report on the Implications of Cloning for the Welfare of Farmed Livestock (1998)*. We referred to the general principles of the Banner Committee and we adopted its ethical framework in that a procedure may be considered intrinsically objectionable for any one of the following reasons:

- a) It results in very severe or lasting pain on the animals concerned;
- b) It involves an unacceptable violation of the integrity of an animal;
- c) It is associated with the mixing of kinds of animals to an extent which is unacceptable;
- d) It generates living beings whose sentience has been reduced to an excessive extent

105. Whilst points a) and c) in the above should be adequately catered for under current welfare regulations, decisions about unacceptable violation of integrity or reduction in sentience are not.

106. FAWC's Cloning Report commented on potential problems concerning violation of integrity or unnaturalness which, in the absence of suitable controls, might well result in a significant insult to the animals involved. We stated that we shared concerns expressed to us in the consultation exercise that "an attitude may be developing which condones the moulding of animals to humankind's uses, irrespective of their own nature and welfare". In the case of cloning, this was a perception of a cloned animal as a manufactured being, which to some in

society is offensive. We also stated that, “it is not clear that a radical distinction between human and non-human is now defensible, either biologically or ethically, nor that any such disjunction is sufficient to warrant the treatment of other living creatures merely as means. We owe respect to other animals, and especially to those which we choose to domesticate.”

107. Both conventional and novel breeding techniques have the capacity to produce animals whose integrity has been altered to an unacceptable degree. The problems of addressing this complex question have already been considered in the section ‘Gaps in current regulations’ (paragraphs 41-59), where we stated that we support the recommendations of the Banner Committee and the AEBC that there is a need for consideration to be given to these questions. The following examples further illustrate the type of problems that need to be considered.

108. An example of a possible candidate for such ethical consideration is the featherless broiler chicken, produced in Israel by conventional breeding methods. Such an animal might not be excluded from commercial production on welfare criteria since it is feasible that the environment for which it was selected may actually favour baldness. However, it might be argued that such a significant change to genotype or phenotype should be prohibited from entering commercial production on the grounds that it constitutes an intrinsically objectionable change to the nature or ‘integrity’ of the animal.

109. Another example where a broader set of ethical considerations, rather than a purely welfare based approach, might be required is for the commercial acceptability of a strain of laying hens that are “genetically blind”. Researchers in Canada concluded that when compared with sighted hens, the blind birds laid more eggs, consumed less food, were less affected by flock size and stocking density, and had better feather cover. The researchers suggested that on the basis of their evaluation of welfare, the blind birds may have reduced stress levels and that it was worthwhile to explore further the potential of this mutation in egg-laying strains kept in cage systems.

110. A final issue, briefly addressed in the section ‘Gaps in current regulations’ (paragraphs 41-59), is that of selecting animals for behavioural traits. A reduction in sensitivity to the environment is a general effect of domestication in many species, but FAWC is aware that selection for temperament is becoming increasingly important in breeding programmes. This is particularly the case for species such as pigs and laying hens, where a move away from close confinement systems, driven by either legislation or market forces, has revealed the importance of behavioural traits such as reduced levels of aggression. Whilst breeding for temperament has been carried out for hundreds of years, the protection of behavioural flexibility and sentience in animal breeding is becoming an issue where regulation may be necessary.

111. The above examples demonstrate the wide range of issues that demand proper ethical evaluation on the basis that they constitute major changes to the integrity or sentience of animals. For simplicity, we have chosen not to address the possibility that these examples pose a more obvious risk to welfare, for example, that ‘blind’ chickens are more efficient because they are less active.

PART IV: PROPOSAL FOR A STANDING COMMITTEE TO CONSIDER ANIMAL BREEDING IN AGRICULTURE

112. Against the background of the problems identified by FAWC throughout this report, we recommend a vehicle through which the majority of these can be addressed:

Recommendations:

113. FAWC recommends that a Standing Committee be established for the evaluation of new and existing breeding technologies as well as for the consideration of welfare and ethical problems arising as a result of livestock breeding programmes.

114. FAWC recommends that the Standing Committee provide advice to Government on the effectiveness of existing legislation, and the possible gaps that exist, relating to farm animal breeding procedures, in order to promote animal welfare.

115. FAWC recommends that the Standing Committee give due consideration to ethical questions associated with animal breeding even where measurable detrimental effects on animal welfare may not be immediately evident.

116. FAWC recommends that any breeding technology, whether developed within the UK or overseas, be thoroughly evaluated by the Standing Committee prior to, and during, its incorporation into commercial agricultural practice in the UK.

Proposed model for the Standing Committee

117. FAWC has considered carefully whether the proposed Committee would operate most efficiently and appropriately within or outside the umbrella of FAWC. Given the obvious overlap in subject and remit, FAWC's international recognition for its advice on farm animal welfare, and the good working relationships that the Council has with many sectors of the UK livestock industry and welfare interest groups, we are of the view that it would be appropriate and advantageous for the proposed Committee to be closely linked to FAWC in the form of a Standing Committee of FAWC. However, the membership would be largely, if not entirely, appointed from expertise outside the membership of FAWC.

118. FAWC's typical working method is to focus on a specific topic and produce a report and recommendations over a period of two to three years for the action of either Government or the food and farming industry. Most of the issues raised in this current report would require a very different approach, as progress would only be made as a result of long term programmes of work, often in close co-operation with breed companies. The resource issue that this additional working practice would present, in addition to the specialist expertise that the Committee would require, is a key reason why the existing members of FAWC would be unable to fulfil the role and remit of the proposed Committee, and therefore why a Standing Committee with a separate membership is essential.

119. To strengthen the link between FAWC and its Standing Committee, the Chairperson of the Committee should be appointed to FAWC and should, as with all members of the Standing Committee, be appointed by Ministers. Advice to Ministers from the Standing Committee would normally be provided via FAWC. Thus, all reports from the Standing Committee would normally be endorsed by FAWC and presented to Ministers as FAWC Reports.

120. The Standing Committee, established and appointed by Ministers, could be known as the **FAWC Animal Breeding Committee (FAWC ABC)** and should be composed of members representing a broad spread of expertise and interests, together with lay representation and, importantly, an independent chairperson. The composition of the Committee should be wide enough to cover all major areas of interest and also have sufficient in-depth expertise to evaluate the evidence brought before it. For instance, given the Committee's remit, it would be essential to include at least one specialist in molecular genetics in the Committee membership. Additional expertise may be introduced through secondment of experts as members to assist with specific issues.

121. In recognition of the long term issues that the Committee will address, it would be advantageous for the term of appointment of Committee members to be longer than that of FAWC members. This could be, for example, five years.

122. FAWC proposes that the Standing Committee would work from information from a variety of sources such as Ministers, Government departments, the State Veterinary Service, the Home Office Inspectorate, the VLA, RCVS as well as from FAWC itself. It should have the freedom to determine its priorities for investigation and have the facilities to make in depth studies of new or complex issues.

123. Given that a major part of the Committee's work would be associated with the surveillance of specific welfare problems, it would be essential to establish appropriate mechanisms to provide this information, such as the collection of good quality data that allows analysis of genetic and environmental effects on important health and welfare traits. For some species this data may in effect be already available, for example, data on lameness and somatic cell count are collected in dairy cattle and have been analysed to examine the respective contribution of genotype and environment. However, for other species it is likely that a greater range of traits requires to be measured and steps would need to be taken to incorporate these in existing measurement schemes.

124. Where available, existing data should be utilised. However, where new information is required, this should be obtained through the promotion of industry partnerships and utilisation of research procurement mechanisms already in existence within Government. The obvious overlaps between the requirement of the Committee for farm-level data and the development of the Government's Health & Welfare and Veterinary Surveillance strategies should also be acknowledged.

Recommendations:

125. FAWC recommends that targeted surveillance is made of farms where new breed types or new breeding technologies are first introduced into commercial practice, and that the

welfare impact of all such developments is reviewed throughout a period of normally not less than 5 years after introduction into commercial agriculture.

126. *In order to determine the consequences of current breeding strategies or any new breeding technology and to provide essential feedback on welfare performance for breed companies, FAWC recommends that a robust surveillance system be established. This should accurately monitor the incidence of specified on-farm welfare problems and be capable of providing information on welfare problems associated with breeding strategies or technologies and to determine the respective genetic and environmental contributions. This surveillance system should include extensive data currently collected, for example, by breed societies and breed companies, and should be developed in association with, and as part of, the Government's Animal Health and Welfare and Veterinary Surveillance Strategies.*

127. As far as possible, the Standing Committee will be required to work in an open and transparent way, recognising however that certain issues may be subject to strict commercial confidentiality. The issue of confidentiality could be overcome by negotiation of binding confidentiality agreements as already exist between breeding companies and academics involved in analysing their data.

128. The Standing Committee would be required to operate in a manner which would not place a disproportionate bureaucratic burden on agriculture, although it is important to recognise that some advice will be far from straightforward and would involve in depth discussion with experts in particular fields. In many cases, the Standing Committee would advise the continued field surveillance of a particular genotype or technique before making a final recommendation.

129. Given the considerable public concern over breeding technologies, particularly within areas such as GM and cloning, it would be essential for the proposed Committee to be perceived by the public as a responsible voice on such issues, in much the same way as the Human Fertilisation and Embryology Authority (HFEA) or, in New Zealand, the Bioethics Council. For this reason the Committee should be demonstrably independent and should also have a role whereby it engages in a two-way dialogue with the public.

130. The Standing Committee will require the support of an effective, adequately resourced secretariat and must have access to resources to enable research and surveillance to be commissioned for particular issues under consideration.

131. Whilst FAWC has considered breeding related welfare problems in farm animals, consideration could be given to expanding the role of the proposed Standing Committee to cover similar problems found within companion animals. In this way, the Committee could engage with CAWC in addition to FAWC.

Concluding remarks

132. FAWC has considered carefully the options available for addressing the broad range of ethical and welfare issues that relate to breeding and the application of breeding technologies in farm animals, as raised in this report.

133. We believe that any failure to address the issues highlighted presents a significant risk to Government, the livestock industry and, most importantly, to animal welfare. For example, there is considerable public disquiet about genetic modification, cloning and some novel breeding technologies. At the present time it is difficult to predict the extent to which developments in these fields will become incorporated into livestock breeding programmes. However, it seems reasonable to assume that public opinion will be an important factor influencing developments in these areas. A crucial role of the proposed Standing Committee would be to be seen by the public as a trusted and reliable body to provide balanced advice to Government and at the same time to listen to public concerns about such matters.

134. In addition to helping avert potential risks, the proposed model for a Standing Committee would provide a number of other benefits. For example, analysis of data from an effective welfare surveillance system would provide information on both genetic and environmental influences on health and welfare, thus allowing both aspects to be addressed in a coherent way. Such a welfare surveillance system would also allow welfare problems to be addressed when they first become apparent and not, as is often the case, many years after they develop.

135. In the same way, research effort in many areas of farm animal welfare could be much more effectively and carefully targeted if accurate data on the prevalence of welfare problems were available. The proposed welfare surveillance system would, in itself, be a resource of enormous value in that it would allow trends in a wide range of welfare problems to be monitored, thereby assisting Government and other interested parties (e.g. research groups) to focus attention on the most pressing problems. At the same time it would allow industry to demonstrate where recognised welfare problems were being addressed, both through selective breeding as well as through management.

136. Animal breeding and the use of breeding technologies is a dynamic and growing field that has the potential to influence animal welfare in a positive, as well as negative, way. The proactive approach recommended by FAWC to address the issues raised in the report would ensure that neither progress nor welfare are compromised.

COMMENTS AND RECOMMENDATIONS FROM PREVIOUS FAWC REPORTS

(i) Report on the Welfare of Broiler Chickens, April 1992

44. It is apparent that there are many possible remedies for leg problems but none which will alone solve the entire problem. Therefore, we look to the industry to take steps to tackle this matter. Principal methods of reducing leg problems are outlined here for the guidance of those concerned:

i) *Genetically* – by the increased selection of breeding stock for strong and well-formed legs. The council acknowledges that the industry is already working towards a reduction in the predisposition of broilers to leg problems. However, this change is too slow and long-term.

45. Having considered all aspects of this problem, including its long-term nature and the attempts already being made by the industry to improve the situation, *the council concludes that the current level of leg problems in broilers is unacceptable. We recommend that steps should be taken to ensure that there is a significant reduction in the numbers and severity of leg problems. It will be the responsibility of the industry to achieve this objective and the council intends to look at this aspect of broiler production again in 5 years' time, when significant improvements should be apparent. If no reduction in leg problems is found, we may recommend the introduction of legislation to ensure the required improvements. To achieve these improvements further R&D may be necessary.*

57. Genetic selection has the potential for positive as well as negative effects on welfare. However, the selection of stock for liveweight gain and food conversion efficiency in preference to, and to the detriment of, factors necessary for the welfare of the birds should be discouraged. The selection of stock for the reduction of leg problems is strongly encouraged (see paragraph 44).

(ii) Report on the Welfare of Sheep, April 1994

97. Traditional breed structures have been under change in recent years in response to the demand for 'improved' leaner carcass conformation. We are concerned that such changes are at the expense of the welfare of the sheep involved, particularly in extensive environments.

98. *We recommend that if any change in breed or type is contemplated in difficult extensive conditions, replacement must only be with a breed or type which is sufficiently hardy. Account must also be taken of the effect of introducing breeds which are unfamiliar with area.*

99. *We recommend that within breed improvement selection programmes, monitoring is carried out for problems associated with selection for greater muscularity.*

100. The body condition of the ewe and nutritional management around mating time are

well proven to have a marked effect on the ovulation rate and thus litter size. In addition, there are other methods of manipulating time of lambing and litter size. This is an obvious opportunity for the use of the scanning technique (see paragraphs 52-54). The use of artificial melatonin treatment of the ewe may be used to induce reproductive activity about 6 weeks earlier than normal.

101. *We recommend that if any procedure to increase litter size is instituted, account must be taken of the extra requirements in welfare, feed, labour and other inputs before and at lambing time.*

102. *We also recommend that appropriate housing or shelter should be available if lambing is to take place outside the normally recognised breeding period in adverse weather conditions.*

103. Many sheep farmers use cervical artificial insemination as an aid to genetic improvement. There has, however, been a recent development whereby semen is deposited directly into the uterus beyond the cervix. We believe that the difficulties associated with the technique of transcervical A.I. mean that it should not be carried out by anyone other than a veterinary surgeon. Embryo transfer is a technique only for use by approved teams led by a veterinary surgeon.

104. *We recommend that only a qualified veterinary surgeon trained in the technique should perform transcervical A.I. in sheep.*

(iii) Report on the Welfare of Turkeys, January 1995

84. Large breeding stags which are used as grandparent stock to influence the genetic pool have the greatest potential for leg disorders. There are very extreme types with a high predisposition to lameness. Very few breeding stags are taken to excessively heavy weights but those we saw had unnatural gaits and some had difficulty in walking.

85. Breeding policies adopted across the world make it inevitable that a small number of grandparent stags will be reared to extreme weights and size. These birds should not be allowed to suffer. We know of evidence that the older, heavy breeding stags may be affected by severe degenerative joint disease and experience pain during movement as a result. Further research is required to establish whether or not these lesions occur in younger breeding stock, particularly males; and to determine the potential for suffering and whether or not the lesions are related to excessive weight or abnormal conformation. In the meantime, management practices must seek to minimise the occurrence of leg pain in heavy stags by careful selection, vigorous culling and reduction of the energy intake levels. Culling should occur immediately a problem is manifest and breeding companies must not continue to collect semen once a stag shows signs of suffering.

86. *We believe that some grandparent stags have been taken beyond the limit of acceptability and that it would not be appropriate to continue to select for increased weight without first improving leg strength.*

87. *We recommend research to establish at what point leg problems, particularly in heavy breeding stags, result in pain or other aspects of poor welfare and into the predisposing factors and pathological lesions which may be associated with leg disorders.*

88. *"Shaky leg syndrome", which appears to be the commonest leg disorder of turkeys, is not characterised by any distinctive pathology. The condition requires further research.*

89. *Farmers and breeding companies must rigorously cull birds which are suffering as a result of leg disorders.*

90. *Heavy grandparent birds should not be kept to advanced ages.*

(iv) Report on the Welfare of Pigs Kept Outdoors, May 1996

148. The breed of pig selected by the farmer must be suited to outdoor production and it is not acceptable simply to turn out sows which have spent their lives indoors should the farmer decide to convert to outdoor production. The pig should be of a hardy type, able to cope with most climatic conditions in this country, and with good mothering instincts. The breeding companies have reacted to market demands and have developed genotypes which are both hardy and which produce a carcass quality and production efficiency which compares well with pig meat produced indoors.

149. It is the practice in the UK to select relatively docile sows for outdoor production on the basis that they are easier to manage and have good mothering instincts. As a result, injury arising from aggression between animals is relatively rare. The large space available for avoidance and escape, together with proper management attention, also help to reduce aggression. The protective instincts of sows with strong mothering ability should be recognised as being distinct from general aggression towards other stock.

150. *Breeding companies, and those responsible for the selection of breeding stock to be kept on outdoor enterprises, must ensure that only those strains of pig with the genetic potential to thrive in the conditions provided are used.*

151. *When choosing pigs attention should be paid to the need for good temperament and mothering ability. New entrants to the industry should seek independent advice to ensure the correct stock is selected.*

(v) Report on the Welfare of Laying Hens, July 1997

67. We are greatly concerned to hear of an increase over recent years in the incidence of beak trimming of hens in battery cages. This increase may be associated with genetic change in the laying flock. It may also be due to the fact that many hatcheries routinely beak trim since birds may be destined for any system. It seems possible that rather than exploiting

genetic variation in feather pecking and cannibalism to reduce welfare problems, the breeding companies may have inadvertently made the situation worse. Evidence from the USA that genetic selection can significantly and substantially reduce feather pecking and cannibalism is encouraging. There appears to be great potential for genetic selection to overcome, either partly or wholly, the problem of feather pecking and cannibalism and hence the need for beak trimming. We would like to see evidence of a concerted effort by the egg industry and retailers to ensure that the laying hen breeding companies reduce the genetic tendency of the hen to injurious feather pecking and cannibalism.

72. In addition, all breeding companies should be strongly encouraged by the laying hen industry and Government to pursue genetic selection for birds which display less injurious behaviour.

(vi) Report on the Welfare of Dairy Cattle, December 1997

40. *Achievement of good welfare should be of paramount importance in breeding programmes. Breeding companies should devote their efforts primarily to selection for health traits so as to reduce current levels of lameness, mastitis and infertility; selection for higher milk yield should follow only once these health issues have been addressed.*

41. *Breeding programmes worldwide should have as a major objective the need for good welfare. The criteria used should not lead to the production of animals that require above average levels of management to prevent welfare problems.*

151. Subject to the recommendations at paragraphs 40 and 41 of the main text, breeding companies should pay special attention to the selection of cattle with good feet and legs so as to reduce the risk of lameness. This may require the collection and processing of more on-farm data to aid better choice of breeding animals.

152. *Sire selection should take account of good linear assessment scores for foot depth and angle and straightness of legs. Replacements should not be bred from cows or sires with a history of severe clinical lameness or badly deformed feet and legs.*

153. *Bulls should be culled if their offspring have a poor record of foot health and conformation, even though they may be genetically superior in other traits.*

272. In recent years, the desire to increase rapidly the genetic production index has led to a growing acceptance in the industry of embryo transfer. The procedure is currently undertaken on a relatively small, albeit increasing, scale.

273. The procedure in cattle is mainly carried out by superovulation and non-surgical recovery and involves the transfer of embryos which may have been fertilised *in vivo* or *in vitro*. Ovaries may also be collected from dead animals in the abattoir and the ova grown-on and fertilised in the laboratory before transfer. These embryos may be transferred directly or frozen for storage and future use. The procedure for transferring single embryos to carefully

selected recipients does not normally cause welfare problems. The continued use of superovulatory drugs can result in subsequent fertility problems.

274. Embryo transfer has now been simplified with the advent of new knowledge which allows frozen embryos to be thawed very quickly and transferred immediately to recipient females. As embryo transfer is carried out at seven days after the onset of oestrus, the technique is more difficult than AI and requires considerable training and experience. Caution must be exercised if this practice is to become widely available in the commercial field, as embryos fertilised *in vitro* have been implicated in the production of oversized calves. The technique must be carried out using epidural anaesthesia. If a non-veterinarian is administering the epidural, that person must be trained and certified as competent and be a member of an approved bovine embryo team headed by a veterinary surgeon.

275. These procedures are regarded by the industry as part of the normal array of reproductive techniques and welfare concerns are, by and large, addressed by The Bovine Embryo (Collection, Production and Transfer) Regulations 1995 and the Royal College of Veterinary Surgeons' Code of Practice for Embryo Collection and Transfer in Cattle. Invasive techniques of this nature should not be undertaken lightly. In particular, the transfer of embryos which are likely to produce calves of a size or shape which will cause problems at calving, or increased likelihood of caesarean section, is unacceptable. We have recommended previously that the Belgian Blue should not be used on maiden heifers, either as semen or by embryo transfer.

276. The effects of repeated administration of superovulatory drugs and repeated epidural anaesthesia should be kept under review. The industry should maintain records of problems caused and report findings annually to the Agriculture Departments (see also paragraph 285).

277. The requirements of the Bovine Embryo (Collection, Production and Transfer) Regulations 1995 must be carefully adhered to at all times.

278. The recipient mother should be able to carry the chosen embryo to term and to calve normally, without recourse to caesarean section. Caesarean section must not become a routine part of the procedure.

279. A record of caesarean sections resulting from embryo transfer should be maintained and submitted annually to the Agriculture Departments who should monitor the situation.

280. Embryo transfer which does not fulfil these criteria should be regarded as causing unnecessary pain and unnecessary distress.

*283. We have considerable concerns regarding oversized calves resulting from *in vitro* fertilised embryos that can cause difficulties at calving. It is essential that research is pursued as a matter of urgency. We intend to review the evidence within five years of this report.*

285. Repeated epidural injections to allow for collection of oocytes by follicular aspiration as frequently as twice a week can cause welfare problems, such as chronic pain in the tail head and fused vertebrae, and requires urgent study. Pending these results, the frequency of

ovum pick-up should be limited. The industry should be required to maintain records of problems caused and to report its findings annually to the Agriculture Departments.

288. *When commercially available, the sexing of semen should be used to reduce the number of unwanted male dairy calves, provided that the technique has not been shown to produce adverse effects.*

(vii) Report on the Welfare of Broiler Breeders, August 1998

81. The problem of hunger in broiler breeders is not easy to solve with present strains of birds and is likely to get worse if selection for fast growth continues. A long-term solution is to change the genetic strains but, in any case, breeders must avoid exacerbating the problem and reduce their demand for ever increasing growth rates.

82. *The objectives of the breeding companies in the future development of strains of broilers should include welfare improvement, in particular the avoidance of problems of prolonged hunger in broiler breeders.*

89. Breeding companies have the opportunity to investigate the relationship between strain of bird, stocking density, house environment and feeding regimen. Selection against traits which have a negative effect on welfare, such as injurious pecking behaviour, should be pursued with vigour. There appears to be potential for genetic selection to overcome the problems of feather pecking and cannibalism and hence eliminate the need for beak trimming. We urge breeding companies to make strides to reduce significantly the tendency to injurious pecking.

(viii) Report on the Implications of Cloning for the Welfare of Farmed Livestock, December 1998

25. We have considered carefully the welfare implications of the procedures involved, and have concluded that it is most important that *in nuclear transfer, the recipient dam must be of an appropriate size in relation to the size of offspring to be produced. Regulations should be introduced requiring the suitability of the dam to be certified by a veterinary surgeon in a manner similar to that required in embryo transfer.*

[From the summary of recommendations]:

3. We have identified three key areas where we believe that greater knowledge and understanding is required. We consider that:

3a. *a greater understanding is required of the underlying causes of oversized offspring, especially of the effects of in vitro culture on foetal size;*

3b. *research is needed into the causes of embryonic and foetal deaths and of perinatal losses and birth abnormalities associated with nuclear transfer, and the scale of these problems; and*

3c. *research into the long-term effects of nuclear transfer of aged DNA is required before the technique should be considered suitable in agricultural practice.*

4. Bearing in mind this requirement for additional information, we make an overriding recommendation that, until the problems of oversized offspring, embryonic and foetal losses and birth abnormalities, and the possibility of problems associated with aged DNA, have been satisfactorily resolved, there should be a moratorium on the use of cloning by nuclear transfer in commercial agricultural practice.

5. We were concerned to learn that, in the current practice of nuclear transfer in sheep, oocytes are cultured *in vivo* which involves the accrued stress of a surgical procedure with recovery followed by killing of some animals. Whilst we accept that the number of animals involved is small, we nevertheless believe that *surgical intervention of animals used for in vivo culture with subsequent killing should be avoided. Further research is required to minimise stress in, and avoid wastage of, such animals. Research should also be undertaken to develop in vitro culture methods.*

6. Furthermore, in addition to the need for greater understanding and knowledge, we have identified the need for a new regulatory structure and therefore recommend that, *before cloning is permitted in commercial agricultural practice, legislative controls must be introduced. These must include:*

a) regulations to give protection to cloned farmed livestock similar to that enjoyed by research animals, at least until the effects of the cloning and any associated genetic manipulation have been scientifically evaluated in the environment of commercial agricultural practice.

b) regulations to ensure the procedure is carried out under direct veterinary supervision by adequately trained personnel.

7. A further aspect of good welfare lies in controlling the competence of those who carry out procedures. We therefore recommend that *the Royal College of Veterinary Surgeons should be consulted to explore the feasibility of any of the procedures involved in cloning by nuclear transfer which are "acts of veterinary surgery" being suitable for delegation to a trained lay operator who has attended an appropriate course and has been assessed for competency.*

8. We also have recognised the importance of good stockmanship and recommend that *stockpeople responsible for the care of animals which arise from cloning must be sufficiently trained and competent to attend to any particular requirements of such animals.*

9. We consider that loss of genetic diversity may have a deleterious impact on welfare. Consequently, we recommend that *an effective system of control of cloning by nuclear transfer, or similar means, must be implemented to ensure that genetic diversity is maintained and other adverse effects prevented. Such control may need to be statutory and should ensure that proper breeding records of any animal produced by such cloning are maintained for several generations.*

10. We consider that implementation of our recommendations will extend over a period of several years during which emerging information will need to be evaluated. We therefore recommend that a *National Standing Committee should be established to oversee the development of cloning technology. The Committee should review outputs of research aimed at tackling the welfare problems identified in this report (and any other problems which may emerge); it should determine the time when it may be appropriate to introduce cloning into commercial agricultural practice; and it should ensure that the controls by then in place are both adequate and effectively implemented.*

11. We also recognise that the advances in this and similar technologies are taking place around the world and there is a need for international guidelines. We therefore recommend that *liaison at an international level should be established to ensure that similar controls are in place wherever this technology is being applied.*

12. Finally we believe there is a need, as a matter of urgency, for a two-way exchange of information on this and related technologies. We therefore recommend that *a means of exchange of information on animal cloning and possibly related technologies, should be put in place as a matter of some urgency. The intent should be both to improve public awareness of the facts and issues, as well as to improve politicians' and scientists' understanding of the fundamental public concerns which undoubtedly exist. Participants should include representatives from the relevant industries and academic groups, as well as politicians and the range of public interests.*

(ix) Interim Report on the Animal Welfare Implications of Farm Assurance Schemes, August 2001

85. We consider that other wider aspects of scheme standards require further attention and research. *We recommend that consideration be given, in particular, to the incorporation of scheme standards, which relate to the breeding and rearing of animals for specific production systems, and also the treatment of cull animals at the end of their productive lives.*

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GLOSSARY

Biotechnology	The application for industrial purposes of scientific, biological principles.
Breeding technologies	Any breeding method other than natural copulation used to accelerate genetic change.
Cloning	The process by which genetically identical progeny are produced by the natural or artificial asexual reproduction of a single organism, cell, or gene.
Conventional breeding	Agriculture not involving GM or cloned animals.
DNA	Deoxyribonucleic acid, which is present in almost all living cells and contains information coding for cellular structure, organisation and function.
Embryo collection/transfer	Collection of a fertilised ova from one female before they become implanted and transfer to another female to complete the gestation.
Embryo transplantation	See above
Embryo	An animal in the early stages of development up to birth or hatching.
Gene	A unity of heredity composed of DNA occupying a fixed position on a chromosome.
Gene-mapping	The process of identifying the position of genes on the genome.
Genetically blind	Lack rods and cones in the retina and cannot perceive light.
Genotype	The genetic composition of an organism.
In vitro	Occurring outside the living organism.
Marker assisted selection	The use of marker genes (a gene or short sequence of DNA that acts as a tag for another closely linked gene) to enhance conventional breeding.
Molecular genetics	Study of the biochemical and biophysical aspects of the structure and function of genes.
Nuclear transfer	A method by which the nucleus of one cell is transferred to another cell from which the nucleus has been removed.
Oocyte	An immature ovum (the female reproductive cell).
Ovum pick-up	An ultrasound guided oocyte collection technology.

Ovum transplantation	See embryo collection/transfer
Pectoral myopathies	Degeneration of the breast muscle.
Phenotype	The appearance of an organism, resulting from the interaction of its genetic constitution with the environment.
Polygenic traits	Caused by many genes.
Selection/breeding index	The use of organisms exhibiting desired characteristics to produce offspring which also bear these characteristics.
Sentience	Having the capacity of sense perception or sensation.
Sexing of sperm	The process by which x-and y-bearing sperm are separated due to their differing mass, thus leading to the potential for offspring of a specified sex.
Superovulatory drugs	Drugs used to increase the number of eggs produced.
Trait	A stable and enduring attribute which varies from one individual to another.

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FARM ANIMAL WELFARE COUNCIL: REPORT ON THE WELFARE IMPLICATIONS OF ANIMAL BREEDING AND BREEDING TECHNOLOGIES IN COMMERCIAL AGRICULTURE

This report covers the Council's views on the welfare implications of animal breeding and breeding technologies in commercial agriculture. It makes a number of recommendations that are applicable to all.

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