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# **Report on Priorities for Animal Welfare Research and Development**

*May 1993*

FAWC, Tolworth Tower, Surbiton, Surrey KT6 7DX



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Minister of Agriculture, Fisheries and Food  
Secretary of State for Scotland  
Secretary of State for Wales

17 May 1993

I have pleasure in submitting the Farm Animal Welfare Council's Report on Priorities for Animal Welfare Research and Development which updates the Report we issued in 1988.

We were pleased to learn that the 1988 Report has been used extensively to plan the Government's commitment to animal welfare research and development and we considered it appropriate to review and update our advice. We hope this new Report will be widely used not only by the Government but also by research institutions, welfare bodies and the farming industry all of whom have a role to play in commissioning and funding new work.

As you will see, there is still much to be done. The Summary at Part III gives a high or a moderate priority to each of our recommendations but there is no overall priority order. However, the Council wishes to stress that urgent attention should be given to research recommended in recent FAWC Reports such as those on transport, laying hens in colony systems and broiler chickens. In particular:- the determination of optimum stocking densities for transported animals; reduction of aggression in hens kept in colony systems; assessment of techniques of break-trimming in poultry in order to minimise pain; reduction of orthopaedic disorders in meat birds; and investigation of methods of castrating and docking lambs to minimise pain.

The Council does not anticipate a formal Government response to all of the recommendations in this Report but Members hope that the Agriculture Departments will continue to support further research and development and will find this a helpful and instructive document.

Professor C R W Spedding  
Chairman  
Farm Animal Welfare Council

## PART I

### INTRODUCTION AND BACKGROUND

#### INTRODUCTION

1. The terms of reference of the Farm Animal Welfare Council (FAWC) are to keep under review the welfare of farm animals on agricultural land, at markets, in transit and at the place of slaughter, and to advise Agriculture Ministers of any legislative changes that may be necessary. The Council has the freedom to consider any topic falling within its remit.
2. Since it was established in 1979, FAWC has produced a number of reports on a wide range of issues which included, in 1988, a Report on Priorities in Animal Welfare Research and Development. This contained advice about specific priority areas and took account of information provided by a number of leading experts in animal welfare R & D. In submitting it to Agriculture Ministers, the Council indicated that it was important for Government and research bodies to bear the recommendations in mind when drawing up animal welfare R & D programmes.
3. We acknowledged in 1988 Report that the Government had identified animal welfare as a priority area and we note that this commitment has continued. We also note that commissioning arrangements in the Ministry of Agriculture, Fisheries and Food (MAFF) were reorganised in 1990, which resulted in a commitment to make more explicit the policy basis for its research programmes. Strategies clearly setting out the relationship between policy and the supporting research programmes are now prepared and updated annually to take account of developments in science or policy. FAWC welcomes any change which will increase the effectiveness of animal welfare R & D but hopes this will not lead to a reduction in Government financial resources available for animal welfare studies. However, we realise funds are finite and that it is necessary to prioritise areas of future animal welfare research to help ensure that money is put to the best available use.
4. We have consulted Government officials with policy responsibility for animal welfare to determine research action taken since our 1988 Report. We are pleased that the Report has been widely used by those with an input to commissioning decisions. Nonetheless, there are priority areas which have still to be considered. In view of this, the progress made since the last Report and the changes in the commissioning arrangements for Government sponsored R & D, we decided to produce this new Report to update the advice given previously. The task was delegated initially to the Research and Development Working Group (see Appendix A). The Group's objectives were to consider the progress made since 1988, identify any areas where further work was necessary, review the new priorities which had emerged (including recommendations from subsequent FAWC Reports) and suggest future priorities for fundamental and strategic R & D and for applied R & D for individual farmed species. The Group's conclusions have been discussed and agreed by the full Council which also agreed that the Report should be published as a Council document.
5. We hope our advice will be widely read and that it will be used to plan future animal welfare R & D commissioned not just by Government and related bodies (e.g. the AFRC) but also by welfare organisations, the farming industry and others. We

consider that the industry has an important part to play in the commissioning and funding of animal welfare research.

### **WHY THE NEED FOR R & D?**

6. Animal welfare is an area of growing public concern. There is ever increasing pressure on Government and the European Commission to recommend or legislate for changes to certain current farming practices in order to improve animal welfare. The Government is seeking the fullest degree of harmonisation so that all countries of the Community operate to the same high standards. Research is needed to identify welfare problems, to develop more objective assessments of welfare and to develop practical alternative and improved systems of husbandry, transport and slaughter. Animal welfare research is therefore carried out for the following reasons:-

#### **i) To safeguard the welfare of animals**

Ultimately, animal welfare R & D is carried out to ensure a reasonable quality of life for animals and a humane death. This includes work on:

- Behaviour and biology of farm animals.
- Development of alternative and improved systems of production for enhanced animal welfare.
- Improving transport, slaughter and handling systems.
- Improving building design to enhance animal welfare.

#### **ii) To improve UK and EEC Regulations**

Although measurement and evaluation of welfare may be inexact in some areas, research will help to reveal more indicators as to the physical and mental states of animals. This information can be used to demonstrate the rationale for improvements in farm animal welfare in domestic and EC legislation.

#### **iii) To provide alternative and improved systems of husbandry, transport and slaughter**

Ideally, environments for farm animals should not only minimise the poor welfare which is associated with discomfort, distress, fear and frustration but positively promote good welfare. Analysis of an animal's needs in terms of external and internal motivating forces requires research in physiology and ethology whose ultimate objective is the design of more humane environments. The purpose of some welfare R & D will therefore be the development and assessment of so called 'alternative systems' which satisfy animals' needs better than current husbandry practices. Other studies will develop improved transport and slaughter procedures which are more humane.

#### **iv) To persuade the industry to change**

Producers, processors and retailers sometimes give economic considerations as reasons for doing nothing to improve welfare. However, R & D can help to show that positive welfare can sometimes have financial benefits. It can also indicate that alternative systems can operate as effectively as those in general use. R & D

can demonstrate where existing practices do not satisfy the needs of animals and can indicate to the industry where changes should be made. The continued success of the farming industry depends on the quality of the product and the method of production and this must include the quality of welfare as perceived not only by the consumer but also by the animal itself.

#### **v) To improve FAWC advice and recommendations and raise welfare standards**

Both ethical and scientific issues play their parts in determining animal welfare standards. R & D is essential to provide an objective basis for ethical decisions as to the limits of acceptability within existing systems, whether intensive or extensive, which combine the use of appropriate new technology with efficient use of available resources and adequate provision for the needs of the animal.

#### **vi) To reassure the consumer and to offer credible choices (by defining good welfare systems and practices)**

Animal welfare R & D has been identified as a 'public good' area, i.e. a subject where the Government sees that it has a duty to society to carry out R & D. Welfare is assuming a higher profile in the public eye and influencing purchasing habits. R & D can help to provide consumers with objective assessments of different production systems which will make possible the responsible and informed exercise of choice.

7. These considerations create a demand for more R & D in all these areas in order to improve animal welfare standards and satisfy society's desire to safeguard the welfare of those animals it uses for the production of food and other products.

### **METHOD OF INVESTIGATION**

8. The welfare of an animal includes its physical and mental state and we consider that good animal welfare implies both fitness and a sense of well-being.

9. The Council believes that the welfare of an animal, whether on farm, in transit, at markets or at place of slaughter should be considered with reference to "five freedoms". These define ideal states rather than standards for acceptable welfare. Nevertheless they form a logical and comprehensive framework for analysis of welfare within any system together with the steps and compromises necessary to safeguard and improve welfare within the proper constraints of an efficient livestock industry. Our Report has taken full account of this framework.

#### **(i) Freedom from thirst, hunger and malnutrition**

- by ready access to fresh water and a diet to maintain full health and vigour.

#### **(ii) Freedom from discomfort**

- by providing an appropriate environment including shelter and a comfortable resting area.

- (iii) Freedom from pain, injury or disease
  - by prevention or rapid diagnosis and treatment.
- (iv) Freedom to express normal behaviour
  - by providing sufficient space, proper facilities and company of the animal's own kind.
- (v) Freedom from fear and distress
  - by ensuring conditions and treatment which avoid mental suffering.

**10.** In acknowledging these freedoms those who have care of livestock should practise:-

- caring and responsible planning and management
- skilled, knowledgeable and conscientious stockmanship
- appropriate environmental design
- considerate handling and transport
- humane slaughter.

**11.** A great deal of information about Government-sponsored animal welfare R & D has been made available to us. We are equally aware that many organisations outside of Government commission research on animal welfare. Where possible, we have tried to gather details about the major projects commissioned by others so as to obtain as complete a picture as possible. We have also approached many of the major research establishments in this country and elsewhere in Europe and taken note of work currently being undertaken by them. We are grateful to these and all other organisations and individuals who submitted comments and information (see Appendix B for the list of contributors).

## PART II

### ACHIEVEMENTS SINCE 1988 AND PRIORITIES FOR FURTHER RESEARCH

#### INTRODUCTION

**12.** In this part of the Report we identify the main strategic questions in farm animal welfare research and development, briefly review achievements within these subject areas since our last Report in 1988\* and recommend priorities for new R & D. We also draw attention to some important problems of animal welfare which may not rate a high priority for new R & D, either because they are already attracting an appropriate proportion of existing research funds or because the most significant improvements in welfare are likely to accrue from existing knowledge. Whilst this Part of the Report does not list our recommendations in order of priority, Part III contains a full list together with an indication of the priority which should be given.

**13.** The subject areas are as follows:-

- A. Indices of Welfare.
- B. Perception and Cognition.
- C. Health.
- D. Pain and Injury.
- E. Design and Management of Husbandry Systems.
- F. Transport.
- G. Slaughter.

**14.** Fundamental study of the capacity of an animal species to perceive and comprehend incoming sensations, then evaluate them in terms of quality of life is an essential pre-requisite to the design and management of husbandry systems adapted to the real needs of farm animals rather than public perception of what is 'natural'. It is equally important to develop a comprehensive portfolio of physiological and ethological techniques for evaluating good and bad welfare; too many 'welfare' papers in the past have inadequately defined psychological stress by reference, for example, to plasma concentration of a single hormone, such as cortisol.

**15.** Good health and freedom from pain and injury are obviously of paramount importance to good welfare. In this Report we draw special attention to problems of disease, pain and injury that have arisen as a direct consequence of the drive to increased productivity through 'improvements' to breeding, feeding and housing.

**16.** Sections E to G deal with applied aspects of animal welfare R & D, the development of improved systems for feeding, housing, handling, transport and slaughter that seek to achieve a fair compromise between the five freedoms and the commercial realities of animal farming.

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\* A comprehensive list of references to research we have reviewed would be beyond the scope of this Report so no references are made to individual studies.

## A. INDICES OF WELFARE

### INTRODUCTION

17. The welfare of an individual is its state as regards its attempts to cope with its environment. Measurements of welfare include how much has to be done in order to cope and how well or how badly coping attempts succeed. Indicators of poor welfare include abnormal behaviour, abnormal physiology, injury, etc and also measures of the aversion shown by animals to particular conditions or procedures. Good welfare is indicated by absence of the above, the occurrence of normal functioning including normal behaviour and measures of positive preferences for conditions and resources.

18. It is necessary, when attempting to find out how poor welfare is, to use a range of measures. Any one of a variety of measures can indicate that welfare is poor but the fact that one measure, such as growth, is normal does not mean that welfare is good.

### ACHIEVEMENTS SINCE 1988

19. There has been much recent research in which welfare indicators have been used. One important point which is apparent from this research is that there is variation, not only amongst species, but also amongst individuals, in which methods they use to try to cope with difficult conditions. One individual may use a principally behavioural coping response, whilst another may show greater changes in adrenal or heart rate responses. Also, there are several different consequences of failure to cope.

#### i) Behavioural measures.

20. The indicators of poor welfare which have been investigated most in recent years involve measures of behaviour. Actions which are rare in animals kept in good conditions but which occur when animals lack control over their environment include (1) stereotypies such as bar-biting or sham-chewing in sows, tongue-rolling in calves, crib-biting or wind-sucking in horses and route-tracing in many species; (2) self-mutilation; (3) frequent behaviour which damages others even if it is not aggressive, such as feather-pecking in hens; (4) excessive aggressive behaviour; and (5) extreme inactivity and unresponsiveness. Some of these behavioural abnormalities have been studied to a limited extent in relation to other coping mechanisms but the relationships are not very clear at present. Another useful behavioural measure is the extent of the rebound effect which occurs when an animal which has been prevented from showing an activity (e.g. wing-flapping in a caged hen) is finally able to show it. Some progress has also been made in assessing how aversive treatments are by measuring the degree of reluctance of the animal to return to the place where the treatment occurred.

#### ii) Physiological measures.

21. These measures of poor welfare have also been developed further in recent years. The use of heart rate changes to assess short-term welfare problems, such as handling and transport, has been aided by studies in which heart rate changes have been assessed taking account of the level of activity of the animal. The use of measures of adrenal cortex activity to assess responses to short-term problems is well established but it has recently become clear that saliva as well as plasma can sometimes be used

for such measurements. Saliva sampling can be carried out with much less disturbance to the animal and hence is more useful in studies of animal welfare. Recent research has shown that more prolonged welfare problems are not easily assessed using direct measures of adrenal cortex product levels, especially when only occasional samples are taken, but some progress has been made in the use of challenge techniques using adreno-corticotrophic hormone or dexamethasone to give information about how much the adrenal cortex response has been used in the immediate or recent past.

22. Other indicators of poor welfare which sometimes vary in association with, or as a consequence of, adrenal cortex activity are measures of immunosuppression and endogenous opioid activity. A very limited amount of work has been carried out in which the extent of immunosuppression has been used as an indicator of poor welfare. Most of this has involved measurement of antibody titres after treatments lasting some time such as housing in difficult conditions. One or two studies have included measures of T-cell activity in attempts to assess welfare. Preliminary investigations of opioid peptide involvement in responses to difficult conditions have used receptor blockers such as naloxone but such experiments have proved difficult to interpret. Some work on the effects of conditions on opioid receptor density has been carried out and may prove useful. Other neurobiological studies have as yet made little contribution to our knowledge about how to assess welfare.

#### iii) Mortality rates and injuries.

23. The ultimate measure of damage to animals is increased mortality which has been shown in recent studies to be related to short-term problems such as transport or bringing wild animals into captivity, and long-term difficulties such as high metabolic turnover for long periods of time. Another measure is of injury to animals such as bruising, skin lesions or bone breakage prior to or after slaughter. These may also indicate earlier poor welfare. The quantification of the incidence of bone breakage in end-of-lay hens at stunning and the discovery that this is due to a combination of rough handling and bone weakness largely due to lack of exercise in battery cages have been important recent developments.

#### iv) Studies of the preferences of animals and the importance of resources to them.

24. Studies of the preferences of farm animals have been refined in recent years to the point where they are an important source of information when housing and management systems are being designed. The concept of assessing the importance of a particular resource or condition has been incorporated into experimental studies. For example, preferences by pigs for earth to root in or straw to use for nest building have been set against willingness to press a plate repeatedly. Using increasing fixed ratios of reinforcement, pigs' demand for contact with social companions was found to be more elastic than for food. Laying hens were found to have a relatively inelastic demand for a nest prior to egg-laying and information was also obtained concerning the demand of hens and cockerels for sexual partners by assessing the weight of door which a bird would push through to gain access to the resource. The use of progressive ratios of reinforcement has also proved useful in attempts to assess the importance of resources.

25. Some assessment of priorities in animals' allocation of resources has also come from studies of farm animals in semi-natural conditions. For example, sows put much effort into building a nest prior to farrowing. In all of these studies of preferences, the



necessity for obtaining a better understanding of their motivational basis has become apparent.

## RESEARCH PRIORITIES

26. We have identified the following as priorities:-

- (i) To establish the relationships among the various indicators of poor welfare.
  - How are the occurrences of impaired growth rates, poor reproductive success, injury, fear, pain, abnormal behaviour, adrenal responses, heart rate response, or immunosuppression related?
- ii) To develop new methods of recognising and assessing how poor is the welfare of animals.
  - It is likely that we cannot recognise some important indicators at present. Immunosuppression and the role of endogenous opioids are particularly promising areas for development. Brain mechanisms need to be studied at the same time as currently used physiological and behavioural measures, in order to understand and develop useful indicators. Neurobiological studies can only be of value if they are linked directly with existing welfare indicators.
- iii) To explore measures that indicate good welfare.
  - What behavioural or physiological measures are consistently found in environmental conditions that would be expected to give rise to good or enhanced welfare?
- iv) Aversion learning.
  - Aversion learning should be utilised more in studies assessing the extent of aversion which animals feel for particular situations, including those which cause pain and fear.
- v) Preference tests.
  - Positive preferences and the factors which affect the circumstances in which preferences are shown need fundamental investigation so that the results of preference tests can be properly assessed. Further techniques for assessing the importance of resources and conditions for animals should be developed.
- vi) Studies of motivational mechanisms.
  - In order that these other objectives can be attained, basic studies should be carried out on motivational mechanisms which are specifically related to the techniques of welfare assessment.
- vii) Investigations of social organisation and interactions.
  - Since so many animals are kept in groups there should be investigations of social organisation and interactions, in particular those relevant to the occurrence of aggression and other injurious social behaviour.

- viii) Studies of the basis for individual variation in behaviour and coping responses.
  - Differences amongst individuals in the ways in which they can cope with difficulties can be considerable and should be investigated using behavioural and physiological measures.

## B. PERCEPTION AND COGNITION

### INTRODUCTION

27. It is an indication of how rapidly the study of perception and cognition has progressed in the field of animal welfare that the 1988 report did not identify it as a separate area of study. Yet now, in 1993, we feel it warrants a central place in our analysis of farm animal welfare research.

28. Over the past 25 years the study of cognition has been transformed from a taboo subject, unworthy of consideration by animal behaviourists, to one of the most innovative and fastest growing areas of animal research. Farm animals may be capable of more complex thought processes than previously acknowledged by scientists. The ability of animals to plan ahead, to predict the behaviour of others, to learn by indirect observation, to recall absent objects and to deceive, are all areas of active investigation. Acknowledgement of the complexity of animal thought has improved the understanding of animal behaviour and has important applications for the question of animal emotion and awareness.

29. In relation to animal welfare, perception and cognition are the processes whereby information about the state of the animal's body and about the animal's environment are:-

- i) Sensed – transformed from energy (e.g. light, sound or mechanical force) or matter (e.g. scent or digested nutrients) into inputs to the brain via sensory pathways.
- ii) Processed to find significant information.
- iii) Compared with physiological set points or relevant memories.
- iv) Experienced as pleasant or unpleasant sensations by the animal.

### ACHIEVEMENTS SINCE 1988

30. The cognitive abilities of many species, including farm animals, are being studied using a wide range of physiological and psychological techniques. The processing of perceived information occurs at a number of hierarchical levels as the animal extracts the relevant information and discards the noise. Single cell recording from the visual cortex of sheep can identify stimuli into categories (e.g. food, predator). The response of animals (e.g. chickens, pigs) to operant-conditioning experiments has been shown to be influenced both by prior experience and by the context within which the information is presented. For example, cockerels respond differently to threat from a predator in the presence of hens than in the presence of other males, i.e. they are sensitive to who is

nearby. The ability of hens to learn from others may depend on their relationship with their instructor. Such glimpses can only increase our own humility as to the limits of our ability to understand the minds of farm animals and increase our own motivation to improve that understanding.

## RESEARCH PRIORITIES

31. The number of necessary questions relating to animal cognition is almost limitless, since each question needs to be addressed on a species-specific basis and in a specific context. Nevertheless, we propose the following topics as top priority.

- i) Effects of early experiences on perception and recognition.
- ii) Measurement of sensory acuity as a basis for determining optimal levels of environmental stimulation (e.g. light).
- iii) The significance to animals of the concept of objects and their absence (e.g. the absence of a dust bath).
- iv) The ability of animals to recognise other individuals and their mental states.
- v) Cognitive aspects of fear, pain and other suffering.
- vi) Innate and acquired perception of humans by farm animals (as a basis for more enlightened stockmanship).

## C. HEALTH

### INTRODUCTION

32. As we indicated in our 1988 Report, we believe that full health and vigour are fundamental to good welfare. In most, but not all circumstances, full health and vigour are also a pre-requisite for optimal productivity. Where this is so we see no need to argue that R & D directed towards improved animal health should be embraced within the definition of 'animal welfare research.'

33. There are special circumstances where animals can experience pain and suffering as a result of health problems which (i) do not seriously compromise efficiency of production, or (ii) can arise as a direct consequence of breeding, feeding or housing. Such problems merit research on animal welfare grounds and include lameness associated with disorders of the feet and limbs, physiological disorders associated with high levels of production and infectious diseases associated with intensive stocking levels.

34. For some of the areas where health and welfare are linked, the solution to the problem does not necessarily require further R & D, it is often sufficient to apply existing knowledge. R & D is required either when the solution to the problem is unclear or to establish the extent of pain and suffering associated with 'production diseases' and thereby define the acceptable limits of humane treatment.

## ACHIEVEMENTS SINCE 1988

35. We consider the following have been major achievements:-

- i) Lameness of feet and limbs.
  - Increased awareness of skeletal disorders in poultry has stimulated a considerable increase in fundamental research on bone growth and development in broiler fowl, pain associated with arthritis and effects of nutrients and hormones. Attempts are being made to breed out skeletal disorders in broiler fowl and turkeys.
  - Administration of analgesics to growing turkeys approaching slaughter weight increases mobility. This confirms that the inactivity of such birds can be attributed to pain and increases the urgency of the problem on welfare grounds.
  - Epidemiological analysis of the multifactorial causation of cattle lameness continues. There is some current work on improved floor surfaces. The exact aetiology of laminitis remains obscure and unlikely to yield to anything short of large-scale and expensive research. A great deal can be done to reduce lameness in dairy cattle by application of existing knowledge.
  - New knowledge of the perception of chronic pain associated with foot lameness in sheep, suggests a reduction with time in pain threshold. This too increases the urgency of the problem.
- ii) Physiological disorders associated with high production levels.
  - R & D within the UK into production diseases of cattle has effectively ceased. In view of the high priority we give to diseases arising as a direct consequence of intensification of production, this must be a cause of concern. There is some current research into cardiovascular disease in broilers.
- iii) Environmental infectious diseases at high stocking densities.
  - Many aspects of the complex aetiology of conditions such as respiratory and enteric infections in growing pigs and mastitis in dairy cows remain unclear. There is current work on the spread of pathogens and pollutants in pig houses and their combined contribution to atrophic rhinitis and enzootic pneumonia in pigs. However, the very complex nature of these disease states means that R & D, to be effective, must be large-scale and thus expensive. This inevitably restricts the number of problems that can be tackled at any one time.
- iv) Effects of physical and psychological stress on the immune system.
  - There are several current, relatively small projects to examine associations between stress, immune competence and responses to vaccines in cattle, sheep, pigs and red deer. There is as yet no substantial fundamental programme of research into psychoimmunology in any farm animal perhaps because immunologists (as distinct from welfare scientists) have been unconvinced that this would be fruitful. However, this may change as more precise markers of immunological response to stress become available.

- v) Early recognition of ill health.
  - There is current work on image capture and analysis from free-moving animals. This could create a foundation for the development of new remote-sensing diagnostic tools.

## RESEARCH PRIORITIES

### 36. General priorities applicable to all species are:-

- i) The perception and alleviation of pain (see section D).
  - Fundamental research is needed on this, especially into chronic pain associated with orthopaedic and foot disorders.
- ii) The effects of physical and psychological stresses on the immune system (see section A).
- iii) The development of automatic sensors.
  - These could be used for the detection of fever, inappetance, mastitis, reduced weight gain and possibly lameness. In many intensive systems it is extremely difficult for even the best stockman to conduct regular, effective clinical examinations of each animal. This would follow on from the current work listed at paragraph 35(v).
- iv) Assessment of the disease implications of husbandry systems designed to meet consumer demand for 'natural food'.
  - For example, organic farming or free-range hens.
- v) Welfare problems associated with biotechnology and embryo manipulation.
  - In our previous Report we drew attention to research which could, if applied in practice, possibly lead to a significant deterioration in welfare. This may include the manipulation of body size, shape or reproductive capacity by breeding, nutrition, hormone therapy, manipulation of embryos or gene insertion in such a way as to reduce mobility, increase risk of injury, metabolic diseases, psychological distress, skeletal or obstetric problems and perinatal mortality. There is no *a priori* reason to assume that biotechnology is inherently more likely to precipitate such problems than conventional breeding. However, it is essential to keep the welfare implications of all such work under review and, if any doubts arise, ensure that research is carried out to identify, and where possible resolve, any welfare problems arising from the primary objective of the research (e.g. chronic pain arising from skeletal abnormalities in animals genetically manipulated to increase growth rate).

### 37. Species-specific priorities are:-

- i) Cattle.
  - Automated sensors for mastitis.
  - Epidemiology of respiratory and enteric infections in calves.

- Reduction in damage to cows' feet through improvements to building design and forage management.
- ii) Sheep.
  - Alternatives to laparoscopy for artificial insemination (with frozen semen) and embryo transfer.
- iii) Pigs.
  - Improved control of post-weaning infection without antibiotics.
  - Interactions between pathogens and pollutants in the aetiology of endemic respiratory diseases.
  - Aetiology of degenerative joint disease.
- iv) Poultry.
  - Reduction of orthopaedic disorders in meat birds (broilers, turkeys and ducks). This topic is already receiving considerable attention but many problems remain unresolved.
  - Cardiovascular disease in broilers and turkeys.
  - Bone weakness in laying hens.
- v) Other species.
  - Development of remote sensors for diagnosis of disease and ill-thrift in farmed fish.

## D. PAIN AND INJURY

### INTRODUCTION

38. Pain is a sensation which, without involving higher level brain processing such as that associated with fear, is very aversive. Pain usually involves the specialised nociceptive neurons and often involves some degree of injury. Pain normally elicits protective reflex reactions, causes emotional responses, results in learned avoidance behaviour and may modify social and other behaviour. Detection and assessment of pain in animals relies heavily upon a combination of behavioural and physiological indices.

39. Both pain and injury reduce an animal's welfare and a considerable amount of energy is devoted to the avoidance of pain and injury. The ability of an animal to survive depends upon the integrity of its body systems. In practice, a compromise occurs in that animals compete aggressively for resources where they accept some pain and injury in exchange for the opportunity to feed and reproduce themselves.

40. Good animal welfare implies the elimination, or reduction to a minimum, of the pain and injury suffered by a domesticated animal.

## ACHIEVEMENTS SINCE 1988

41. There has been steady progress towards the establishment of physiological and behavioural indices for the recognition and assessment of pain in farm animals. Work has been concentrated on the pain produced by particular husbandry procedures, i.e. beak-trimming of birds, castration and tail-docking of lambs and foot-rot in sheep. This has elucidated the pain-related behaviour patterns and also demonstrated the peripheral neural mechanisms involved. Lameness in turkeys and broiler chickens has been observed as a problem for twenty years but it is only within the last five years that the extent of degenerative joint disease in these birds has been determined.

42. There have been notable advances in understanding all aspects of the mechanisms of pain, but we are only beginning to comprehend the neural mechanisms.

43. Research projects on the treatment and prevention of pain have probably made most progress, but still the scientific basis for new treatments and the modus operandi of analgesics are imperfectly understood.

## RESEARCH PRIORITIES

44. The following are general priorities:-

- i) The recognition and assessment of pain in farm animals.
  - This continues to be of major welfare importance. To be able to achieve this goal it is important not only to investigate problems related to individual species but also the basic neural mechanisms underlying pain which apply to all species. For example, much work is needed to identify the cellular neural mechanisms related to trauma or infections and pain perception.
- ii) Improvements and extension of physiological and behavioural indices of pain in farm animals and the rigorous testing of their validity.
  - This work is needed to develop measuring techniques which would be validated in the laboratory but could be used under field conditions because it is essential to measure this aspect of the animal's welfare in normal agricultural conditions. Work is required to be able to recognise pains of various types in all species.
- iii) Underlying neurobiology of acute and chronic pain.
  - Although work on beak-trimming in birds and castration in lambs has identified their painful consequences, studies are now required on the underlying neurobiology of both acute and chronic pain to identify the mechanisms responsible for the development of chronically debilitating pain states. This information is essential for the development of methods of assessing, preventing and treating pain.
- iv) Degenerative joint disease (arthritis).
  - This is widespread in poultry and breeding pigs, yet the painful consequences of this pathology are largely unknown. In pigs, the lesions seen in the articular cartilage are similar to lesions seen in humans, horses and dogs

and are therefore likely to be painful but this needs to be verified and assessed. In poultry, a multidisciplinary approach is necessary and we need to know:

- a) The peripheral neural basis for pain.
  - b) The spinal and higher central processing of peripheral pain information; changes in pain thresholds in chronic conditions (e.g. foot and joint lameness).
  - c) The behavioural changes associated with the pathology analysing the general behaviour as well as detailed computerised gait analysis to be able to relate locomotor difficulties with specific pathologies.
  - d) To be able to apply the findings to a variety of different conditions, it is important to know why the pathology is painful; for example, a detailed investigation of the relationship between cartilage degeneration and the responses on peripheral nervous system is needed.
- v) The use of analgesics.
- In the assessment of pain the use of analgesics is a valuable experimental tool and can be used to validate methods of pain assessment as well as treatment of pain and injury. In birds there has been virtually no work on analgesia and in many other farm animals further work is necessary. In the longer-term with work on more basic neural mechanisms of pain new and more effective forms of analgesia are possible.

45. Specific priorities are:-

- i) Assessment of techniques of beak-trimming in poultry at various ages, in order to minimise pain, both short- and long-term.
- ii) Investigation of methods of castrating and docking lambs at various ages in order to minimise pain, both short- and long-term. This should include consideration of an efficient, cost-effective procedure for analgesia during the operations.
- iii) Post-operative pain, especially following non-therapeutic surgery.
- iv) Development of new psychological and behavioural techniques such as the consumer demand approach, passive avoidance and self administration of analgesics could be used to determine the aversiveness of putatively painful procedures.

## E. DESIGN AND MANAGEMENT OF HUSBANDRY SYSTEMS

### INTRODUCTION

46. We should aim to improve man's understanding of animals' perception of management methods and conditions and by the use of this understanding to devise husbandry systems that are economically viable and satisfy, as far as possible, the needs of the animal.

47. Management and husbandry systems are continually changing in response to economic pressures. Whereas in the recent past welfare may have suffered due to intensification which solved the problems of profitability in a situation of limited resources, present changes may create problems of welfare a) by a change from intensification to more extensive systems e.g. hill sheep, b) by inherent disadvantages of the extensive system e.g. free-range hens. However, this is unlikely to be the case across the whole spectrum of animal production and continued intensification will, no doubt, give rise to more welfare problems. Research must therefore be geared to the problems already apparent and also problems that can be foreseen.

48. Most pressure for change may come from an anthropomorphic public attitude but this may create welfare problems in many areas by demands for a specific product which is seen as more animal-friendly, for instance, organic production.

49. Some farmers, particularly in the sheep and poultry industries, are already moving towards less-intensive systems but rather than changing to a new and defined system, many changes are modifications of existing management often with increased responsibility on the stockman (e.g. shepherds expected to look after more sheep). Much work is already being carried out but an increasing demand for behavioural studies is necessary to assess such changes.

#### ACHIEVEMENTS SINCE 1988

50. Public opinion and scientific evidence both point to clear deficiencies in many conventional husbandry systems, especially in regard to comfort and behaviour. It is relatively easy to devise alternative husbandry systems which appear to improve comfort and behaviour but then it is essential to evaluate them systematically in terms of performance, productive efficiency and all five freedoms. The performance of laying fowls in different husbandry systems is being evaluated and other studies have investigated alternative husbandry systems for dry sows and veal calves. Considerable work has been done, particularly on lying areas and the quality of flooring and bedding.

51. New knowledge of animal behaviour and new advances in technology (e.g. computer-controlled feeding stations) will continue to modify our perception of what is acceptable and possible in animal husbandry so there is continuing need to test the implications of these changes in practice. Experimental Husbandry Farms are excellent sites for evaluating alternative husbandry systems. It is unrealistic to expect all such trials to be sponsored by the agricultural industry since most alternatives to existing intensive husbandry systems are not likely to yield economic benefits within existing law. These trials, however, may demonstrate that certain aspects of conventional husbandry are unacceptable and avoidable. If so, they will need to be changed by regulation.

52. Many welfare problems, especially in intensive systems, are imposed by the systems themselves (e.g. lameness in cattle and bone problems in broilers). In some cases the solution is obvious, and management based, without recourse to further R & D.

#### RESEARCH PRIORITIES

53. The following recommendations are restricted to housing and design, as other potential areas for research are covered elsewhere:-

- i) General.
  - Development of systems which allow animals more control over their environment.
  - Economic modelling of 'alternative' systems and the effects of major changes to recognised systems e.g. the ban on stalls and tethers.
  - Collection of basic data on the size and shape of animals and their minimum requirements for space.
- ii) Poultry.
  - Improved designs of cage and colony systems.
  - Reduction of aggression by modification of housing/environment.
  - Improved collection methods.
- iii) Pigs.
  - Optimal housing conditions for dry and farrowing sows.
  - Bedding materials to avoid bio-mechanical damage.
- iv) Cattle.
  - Development of welfare friendly automated milking systems.
  - Reduction of lameness associated with cubicle housing and wet silage.
- v) Sheep.
  - General welfare problems associated with higher ewe/shepherd ratios.

#### F. TRANSPORT

##### INTRODUCTION

54. Almost every farm animal is transported at least once in its life, if only on its journey to slaughter, and transport is invariably carried out by road. In the Council's Report on the Transport of Animals (1991), a journey was defined as being 'the time from when the first animal is loaded to when the last animal is unloaded from the vehicle.'

55. There is no doubt that the transport of animals, particularly to those unaccustomed to it, is to some degree a stressful experience. This is largely to do with its strangeness and is exacerbated at times of loading and unloading. Welfare is jeopardised by, amongst other things, extending travelling times, increased stocking densities and unsuitable extremes of temperatures.

#### **ACHIEVEMENTS SINCE 1988**

56. There has been, and continues to be, a significant amount of work relating to the handling and transport of poultry (mainly broilers and laying hens), including the incidence of fatigue and dehydration in broilers transported for slaughter and air flow/humidity in poultry transporters; and work is also underway on improved techniques for collecting and handling poultry. We understand that there are also projects relating to the maximum transport time for sheep; and provisional plans for similar work with cattle, calves and pigs.

57. Construction of road vehicles, particularly those which board roll on/roll off ferries, has been given much consideration and Agriculture Departments have produced clear guidelines. They have gone so far as to give certificate numbers to multi-tier export containers that meet these requirements.

58. Open-topped vehicles are to be phased out which will undoubtedly remove some welfare abuse resulting from overhead branches and extreme weather conditions. Generally, better design and construction of vehicles have resulted in improved suspension, hydraulic tailgates and improved ventilation. Greater use of tachographs have had a significant effect on the control of drivers' hours and hence journey times.

#### **RESEARCH PRIORITIES**

59. We consider that further work is still required in relation to the development of practical and humane methods of transport and an understanding of the factors affecting animal welfare. In particular:-

- i) The determination of optimum feeding and watering intervals and rest periods.
- ii) The determination of optimum stocking densities.
- iii) Improved vehicle design, particularly for poultry, especially improved control of temperature/humidity at rest and in motion.
- iv) The role of pre-conditioning to reduce stress.
- v) Improved methods of loading/unloading.

## **G. SLAUGHTER**

### **INTRODUCTION**

60. There are extensive provisions for the welfare of animals both immediately before and during slaughter in the Slaughterhouses Act 1974 and the Slaughter of Animals (Humane Conditions) Regulations 1990. Similar provisions exist for poultry. The law requires that all animals and birds are slaughtered either instantaneously or, if prior stunning is used, they must be rendered insensible to pain until death occurs. Furthermore, it is an offence to cause unnecessary pain or unnecessary distress to an animal or bird awaiting slaughter.

61. Notwithstanding these regulations, welfare problems can occur. Animals are sometimes transported long distances to slaughterhouses and this is likely to be exacerbated if the number of slaughterhouses in this country is reduced as a result of Single Market controls. They may then have to wait some hours at the slaughterhouse lairage (and sometimes remain on the vehicle if the lairage is full). Finally, there is the act of slaughter itself. If this is undertaken to meet Jewish or Muslim requirements, the animals may not be stunned before despatch.

### **ACHIEVEMENTS SINCE 1988**

62. We are pleased to note that much of the Government-commissioned R & D on welfare at slaughter has been intended in part to meet specific recommendations made in earlier FAWC Reports. There has been a considerable body of work on animal physiology and stunning and slaughter methods which were priorities in our 1988 Report. The results obtained so far have been used to provide a scientific base for new statutory requirements in the Slaughter of Animals (Humane Conditions) (Amendment) Regulations 1990 and the Slaughter of Poultry (Humane Conditions) (Amendment) Regulations 1990 and for related Codes of Practice. Some projects have yet to be completed but should be soon and we are encouraged to learn that in commissioning further studies, the Government will take account of any priorities identified by FAWC which have still to be addressed. We are aware that there is current work on the humane destruction of day-old chicks and we make the point that if progress could be made on egg sexing there would be fewer unwanted chicks to slaughter.

63. The successful funding and completion of R & D projects, and the implementation of controls resulting from the research is to be commended and has demonstrated the success of cooperation between FAWC, research bodies and the Government. FAWC is delighted to have been responsible, in part, for this achievement.

### **RESEARCH PRIORITIES**

64. Whilst we applaud the support given to slaughter research projects, we consider that further work still needs to be done in the following areas:-

- i) Improved methods for the mechanical handling of poultry (e.g. shackling) to minimise stress and to ensure effective stunning.

- ii) Techniques for pre-stunning fish.
- iii) Further development of mobile slaughter facilities to include and improve their economic viability.
- iv) Techniques to eliminate the production of surplus male chicks.

## PART III

### SUMMARY OF RECOMMENDATIONS

65. This Part of the Report lists all the recommendations for research which are made under the 7 separate headings in Part II. Only headings are listed and it will be necessary to refer to the main text for more details. The recommendations are not in order of priority but each is given our assessment as to whether the work should be given a high or a moderate priority.

#### A INDICES OF WELFARE

Establish the relationships among the various indicators of poor welfare (high).

Develop new methods of recognising and assessing how poor is the welfare of animals (high).

Explore measures that indicate good welfare (moderate).

Aversion learning (moderate).

Preference tests (high).

Studies of motivational mechanisms (high).

Investigations of social organisation and interactions (high).

Studies of the basis for individual variation in behaviour and coping responses (moderate).

#### B PERCEPTION AND COGNITION

Effects of early experiences on perception and recognition (high).

Measurement of sensory acuity as a basis for determining optimal levels of environmental stimulation (moderate).

The significance to animals of the concept of objects and their absence (moderate).

The ability of animals to recognise other individuals and their mental states (high).

Cognitive aspects of fear, pain and other suffering (high).

Innate and acquired perception of humans by farm animals, as a basis for more enlightened stockmanship (high).

## C HEALTH

### General Priorities applicable to all species are :-

The perception and alleviation of pain (high).

The effects of physical and psychological stresses on the immune system (high).

The development of automatic sensors (high).

Assessment of the disease implications of husbandry systems designed to meet consumer demand for "natural food" (moderate).

Welfare problems associated with biotechnology and embryo manipulation (moderate).

### Species-specific priorities are:-

#### *Cattle*

Automated sensors for mastitis (moderate).

Epidemiology of respiratory and enteric infections in calves (high).

Reduction in damage to cows' feet through improvements to building design and forage management (high).

#### *Sheep*

Alternatives to laparoscopy for artificial insemination (with frozen semen) and embryo transfer (high).

#### *Pigs*

Improved control of post-weaning infection without antibiotics (moderate).

Interactions between pathogens and pollutants in the aetiology of endemic respiratory diseases (high).

Aetiology of degenerative joint disease (high).

#### *Poultry*

Reduction of orthopaedic disorders in meat birds (high).

Cardiovascular disease in broilers and turkeys (moderate).

Bone weakness in laying hens (high).

#### *Other species*

Development of remote sensors for diagnosis of disease and ill-thrift in farmed fish (moderate).

## D PAIN AND INJURY

The recognition and assessment of pain in farm animals (high).

Improvements and extension of physiological and behavioural indices of pain in farm animals and the rigorous testing of their validity (high).

Underlying neurobiology of acute and chronic pain (moderate).

Degenerative joint disease (moderate).

The use of analgesics (moderate).

Assessment of techniques of beak-trimming in poultry at various ages, in order to minimise pain, both short- and long-term (high).

Investigation of methods of castrating and docking lambs at various ages in order to minimise pain, both short- and long-term. This should include consideration of an efficient, cost-effective procedure for analgesia during the operations (high).

Post-operative pain, especially following non-therapeutic surgery (high).

Development of new psychological and behavioural techniques such as the consumer demand approach, passive avoidance and self administration of analgesics could be used to determine the aversiveness of putatively painful procedures (high).

## E DESIGN AND MANAGEMENT

### General

Development of systems which allow animals more control over their environment (high).

Economic modelling of "alternative" systems and the effects of major changes to recognised systems e.g. the ban on stalls and tethers (high).

Collection of basic data on the size and shape of animals and their minimum requirements for space (moderate).

#### *Poultry*

Improved designs of cage and colony systems (high).

Reduction of aggression by modification of housing/environment (high).

Improved collection methods for poultry (moderate).

#### *Pigs*

Optimal housing conditions for dry and farrowing sows (high).

Bedding materials to avoid bio-mechanical damage (moderate).



*Cattle*

Development of welfare friendly automated milking systems (high).

Reduction of lameness associated with cubicle housing and wet silage (high).

*Sheep*

General welfare problems associated with higher ewe/shepherd ratios (moderate).

**F TRANSPORT**

The determination of optimum feeding and watering intervals and rest periods (moderate).

The determination of optimum stocking densities (high).

Improved vehicle design, particularly for poultry, especially improved control of temperature/humidity at rest and in motion (high).

The role of pre-conditioning to reduce stress (moderate).

Improved methods of loading/unloading (moderate).

**G SLAUGHTER**

Improved methods for the mechanical handling of poultry (e.g. shackling) to minimise stress and to ensure effective stunning (moderate).

Techniques for pre-stunning fish (high).

Further development of mobile slaughter facilities to include and improve their economic viability (moderate).

Techniques to eliminate the production of surplus male chicks (moderate).

APPENDIX A

**MEMBERSHIP OF THE FARM ANIMAL WELFARE COUNCIL**

Professor C R W Spedding – Chairman

Mr B Atkinson

Mr R H Baker

\* Dr M Baxter

Mr G Berry

Rev A Birbeck

\* Dr W J M Black

\* Professor D Broom

Mr J Dewhurst

\* Mr T Harris

Mrs F Hodgson

Mr C Hollands

\* Miss C A Milburn

Mr R Macpherson

Dr M Pattison

Mr F E Shields

Mr P F Staines

\* Mr J G Thomas

Mrs J Turnbull

Mr A Watkins

\* Professor A J F Webster – Chairman of R & D Working Group

Mrs T Wickham

Dr A Winter

\* Member of the Research and Development Working Group

## APPENDIX B

### ORGANISATIONS WHO SUBMITTED INFORMATION

ADAS, Gleadthorpe

ADAS, Terrington

Agricultural and Food Research Council, Babraham

Agricultural and Food Research Council, Roslin

Animal Health Trust

Animal Welfare Foundation

Institut National de la Recherche Agronomique – France

Institut für Tierzucht und Tierverhalten – Germany

Meat and Livestock Commission

Royal Society for the Prevention of Cruelty to Animals

Scottish Agricultural College

Scottish Office Agriculture and Fisheries Department

Silsoe Research Institute

Swedish University of Agricultural Sciences

The Royal Veterinary and Agricultural University – Denmark

University of Bristol – Department of Animal Husbandry

University of Bristol – Department of Meat Animal Sciences

University of Cambridge – Department of Clinical Veterinary Medicine

University of Ghent

University of Liverpool – Faculty of Veterinary Science

University of Nottingham – Department of Agriculture and Horticulture

Universities Federation for Animal Welfare

## **FARM ANIMAL WELFARE COUNCIL: REPORT ON PRIORITIES FOR ANIMAL WELFARE RESEARCH AND DEVELOPMENT**

**This Report follows advice published in 1988 and makes recommendations to Agriculture Ministers about research and development needs and priorities. It is intended to guide all those involved with animal welfare R & D including the Government, the industry and welfare organisations.**

