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# 14 Animal Welfare: its Scientific Measurement and Current Relevance to Animal Husbandry in Europe

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## Summary

The welfare of an individual is its state as regards its attempts to cope with its environment (Broom, 1986). Poor welfare occurs in situations in which the effects on the animal are adverse in that there is reduced fitness or clear indications that fitness will be reduced, i.e. the animal is stressed, and in other situations where the individual has difficulty in coping with its environment. Welfare is improved by increased control over the environment. Welfare should not be defined solely in terms of subjective experiences. There is a wide variety of measurements of welfare. Behaviour measurements are of particular importance but should be combined with physiological, immunological, injury, disease, mortality risk, growth and reproduction measures in order to obtain complete information.

## The Concept of Welfare

The difficult conditions which animals often encounter during their lives can have effects on the individual which are adverse in that they ultimately reduce its fitness. In order to try to avoid such adversity, animals use a wide variety of coping methods. Coping responses help the animal to control its interaction with its environment and to maintain mental and bodily stability. Both coping responses and direct effects of the environment affect the state of the animal. *The welfare of an individual is its state as regards its attempts to cope with its environment* (Broom, 1986).

Failure to cope means that fitness is reduced. An effect on an individual reduces fitness if it lowers life expectancy, reduces the number of offspring produced per breeding period or increases the interval between breeding periods. If the control systems of an animal are over-taxed to such an extent that there is an actual or potential reduction in fitness then that animal is stressed (Broom, 1988a; Broom and Johnson, in preparation). The welfare of an individual is poor in these circumstances and also when the individual has difficulty in coping with the conditions encoun-

tered. If coping with the environment is easy, however, the welfare is good. Indeed the state of an individual in respect of coping with its environment may be positively affected by pleasurable sensations.

Welfare varies on a continuum from very poor to very good and will fluctuate during life. Fluctuations in welfare are indicated by a wide range of measures. The idea that welfare varies over a range and can be measured using a variety of indicators has also been emphasized by Curtis (1986) and Duncan (1987). The measurement of welfare must be objective and quite separate from any ethical considerations. Once the description of the state of the individual, based on the various measures of welfare, has been made, decisions about whether or not the welfare is ethically tolerable can be taken.

An important concept in relation to understanding animal welfare is the control which an individual has over its environment. Welfare is poorer when the individual lacks control, or feels pain or fear, or is affected by the consequences of lack of control. Conversely, a characteristic of situations in which welfare is good is that in them the individual has effective control over its interactions with its environment. The methods which animals use to try to maintain control and to cope with difficulties include a range of physiological and behavioural responses such as changes in heart rate, adrenal action, movements which reduce pain and actions which result in avoidance of excessive cooling. If there is some degree of loss of control, the consequence may be injury, or behavioural pathologies such as self-mutilation, or impaired immune system function. The amount that individuals are having to do to try to cope with difficulties and the consequences of failure to cope are measures of how poor their welfare is. If it is apparent from observed physiology and behaviour that the individual is effectively controlling its interactions with its environment then welfare can be assessed as being at the good end of the range. Individuals can then engage in low priority behaviour and there may be some indications from behaviour or brain functioning of pleasurable sensation. In general, however, it is more difficult to quantify the extent to which welfare is good.

## Welfare in Relation to Suffering and Other Subjective Feelings

The subjective feelings of an individual are an important aspect of its welfare. Pleasurable or unpleasant feelings are a part of the state of an individual as regards its attempts to cope with its environment. Dawkins (1980) has discussed suffering in some detail and (Dawkins, 1990) has stated that 'suffering occurs when unpleasant subjective feelings are acute or continue for a long time because the animal is unable to carry out those actions that would normally reduce risks to life and reproduction in those circumstances'. This description of the circumstances in which suffering occurs has clear links with the definition of welfare explained earlier in this chapter. Unpleasant subjective feelings will affect the welfare of the individual. Suffering and poor welfare will often occur together but welfare should not be defined solely in terms of subjective experiences (Broom, 1990, 1991a, b). It is possible for the state of an individual to be affected without suffering occurring and most of the measurements of welfare do not give clear information about subjective experiences. Examples of situations in which welfare is poor but there is no suffering include

those in which there is an injury or severe disease condition but the individual is asleep or narcotized. The injury or disease consequence is one aspect of the state of the individual, which means that welfare is poor. Any associated pain or other unpleasant feeling is another aspect of the state which will also have a substantial effect on welfare. Welfare is poor if there is an injury and worse if there is also suffering.

## Measures of Animal Welfare

A few examples of measures of animal welfare are presented here and discussed in relation to what information they give us about the effects of the environment on the animal. Since there are many different methods of coping, and many signs of failure to cope, any one of these measures can indicate poor welfare. Good growth does not necessarily mean good welfare. For more extensive reviews of the subject see Fraser and Broom (1990, Chapter 29) and Broom and Johnson (in preparation, Chapters 5-7).

### Physiological measures

Heart rate varies according to activity level but it also changes when animals are preparing for emergency action. The well-camouflaged hen willow grouse (*Lagopus lagopus*) shows bradycardia (lowered heart rate) when sitting on a nest and approached by a predator (Gabrielsen *et al.*, 1977). This must have the effect of reducing the likelihood that a movement will betray the presence of the bird to the predator. A sheep confronted with a man and a dog, however, will show tachycardia (increased heart rate) superimposed on any heart rate which is a consequence of recent action (Baldock and Sibly, 1990). The increased heart rate is preparation for rapid flight should this be necessary. In both situations, measurement of heart rate gives information about how much the individual is having to try to cope with the situation. There may be no long-term adverse consequences of the situation but the welfare of an individual which shows a very substantial heart rate response is less good than that of an individual which shows a small response. It may be that the subjective experience parallels the heart rate response but we do not know this. Fluctuations in heart rate do occur in people or other species which are anaesthetized and do not have subjective experiences.

Adrenal cortex activity is greater in severe operations on sheep than in minor operations (Shutt *et al.*, 1987) and greater after rough handling of hens being taken to slaughter than after gentle handling (Broom *et al.*, 1986; Knowles and Broom, 1990). There are many other examples of such adrenal cortex responses (Dantzer and Mormède, 1979) and in comparative studies of the effects of treatments a greater response indicates poorer welfare than a smaller response. As with heart rate measurement, suffering must often be greater when the increase in adrenal cortex activity is greater. Indeed Rushen (1986b) has shown that the sort of situations which result in larger adrenal cortex responses cause more subsequent avoidance than do those which elicit smaller responses. However, adrenal cortex responses can occur

when a cut is made in tissue during a farm operation carried out under anaesthesia (D. Mellor, personal communication). The animal could not be said to be suffering but a cut is in itself an indication of poorer welfare, and the adrenal response in such conditions reinforces this. Some adrenal responses occur during courtship and mating when no assumption of poor welfare would be made so care must be taken to interpret these measures taking due account of the context in which they occur.

### **Behavioural measures**

One response to long-term confinement in a small pen is reduced activity and unresponsiveness, perhaps associated with self-narcotization using endogenous opiates (Broom, 1987, 1988a). The process leading to such an extreme response is very likely to involve suffering but if there really is ultimate self-narcotization, it may be that no suffering is occurring at that time. Nevertheless the welfare of an individual which can only cope with its environment by self-narcotizing must be considered to be very poor. Similarly, the welfare of a human drug addict is poor when under the influence of a narcotic drug but there is no suffering at that time, even if there is a great suffering at other times. It is the welfare of the individual throughout these periods which concerns us, not just the period when there is suffering.

Stereotypies are also important indicators of poor welfare (Fraser and Broom, 1990) and their significance in relation to suffering is discussed by Mason (1991b). Whatever the causation of stereotypies, they are shown in situations which are difficult and it is likely that at least some of them are useless and energetically costly signs of brain function pathology (Dantzer, 1986; Mason, 1991a). People with psychiatric disorders, very severely deprived animals and individuals subjected to extreme frustration show stereotypies. They are interpreted as an indication of some temporary or long-lasting psychological problem in man and in other species. Hence they are clearly indicators of poor welfare but as Mason (1991b) explains, while they probably indicate suffering in the past, we have much less confidence in saying that the individual suffers when it is showing them.

### **Immunological measures, injury and disease**

When animals are exposed to difficult conditions, a consequence which may occur frequently is immunosuppression. The efficiency of antibody responses and of cell-mediated immunity can be reduced by a variety of factors including extreme temperature conditions and situations where there is much aggressive behaviour (Kelly, 1980; Siegel, 1985; Broom, 1988b). Any housing or management condition which results in impaired immune system function is clearly not a good one for the animal and welfare is poorer if there is immunosuppression than if there is none. This is still true if no disease challenge occurs and while disease usually results in suffering there need not be any suffering associated with immunosuppression.

The point that injury and disease indicate poor welfare, irrespective of the occurrence of suffering, has been made already. The idea that clinical signs of disease or injury can be indicators of suffering or potential suffering is widely accepted (e.g.

Dawkins, 1988). Information about the severity of pain or discomfort can be obtained from behavioural and physiological measures (Morton and Griffiths, 1985; Fraser and Broom, 1990). The extent of body tissue damage and the degree of disturbance of physiological and behavioural processes give information about how poor is the welfare of the individual. We do not know the actual feelings of the animal but it is reasonable to deduce something about suffering from such measurements. However, it is more precise to speak of effects on welfare, for we know that the state of the individual is altered, than to speak of suffering and, once again, we cannot equate poor welfare with suffering.

### **Fitness measures**

If two animal husbandry systems are compared and the mortality rate is significantly higher in the first than in the second then we can say that the welfare is less good in the first (Hurnik and Lehman, 1988; Broom, 1986, 1988a, 1991a). Similarly, welfare is less good in an animal, perhaps one in a zoo, which cannot reproduce even when a suitable partner is provided, than in an animal of the same species kept in conditions which do allow it to reproduce. In both of these comparisons, the animal whose welfare is poorer may have suffered but we often do not know whether this is so and while we should consider the welfare problem to be exacerbated by suffering, there is still a problem in the absence of suffering.

### **Preference assessment**

It is clear that suffering is one of the most important aspects of poor welfare but that welfare encompasses some effects on animals in addition to subjective experiences. Much valuable information relevant to animal welfare can be obtained from behavioural studies in which the preferences of individuals are assessed. For example, the extent to which a situation is avoided on a second encounter can provide information about how aversive the first encounter was (Rushen, 1986a). Also, as emphasized by Dawkins (1983, 1990) and Duncan and Kite (1987) sophisticated preference tests can give information about the value of a resource to an individual. A strong positive preference indicates that the welfare of the individual is likely to be improved by acquisition of that resource, although care is needed in the interpretation of preference tests (Duncan, 1978; Dawkins, 1990; Broom, 1990, 1991a, in press). The subjective feelings of the individual during the test situation are being assessed in such sophisticated preference tests. Once this information has been obtained, new conditions for the animal can be designed and compared with existing conditions using a range of welfare indicators.

## **Current Relevance to Animal Husbandry in Europe**

The extent of concern about animal welfare in Europe is shown by the fact that Members of Parliament in the United Kingdom and Members of the European Parliament in the European Community receive more letters about animal welfare

than about any other topic. Many of these letters concern farm animals and the ways in which they are kept, transported and slaughtered. Some European countries have a government committee on animal welfare, in some cases a specific committee on farm animal welfare. The committees, the Ministries of Agriculture and the European Commission take much note of scientific evidence when discussing animal husbandry, and formulating new laws or Codes of Practice for use on farms. Scientists studying animal welfare play a considerable part in influencing public opinion and legislation. Indeed it is very important that new laws and recommendations should be based on scientific evidence about animal welfare rather than on emotional responses.

Following the Recommendations of the Standing Committee of the European Convention for the Protection of Animals Kept for Farming Purposes, most European countries have recently brought into force laws whose aim is to improve the welfare of farm animals. The Convention was formulated by the Council of Europe which now includes almost all European countries. Some stricter laws, directives and regulations have been brought in by the European Community and by various individual countries. The laws in Switzerland, Sweden, Germany, the United Kingdom, the Netherlands, Denmark and Norway are among the most progressive.

Examples of recent developments include the requirements for the stunning of animals prior to slaughter with details of stunning currents, etc., limitations on journey duration and stocking density during transport, prevention of certain operations on farm animals, requirements for the use of anaesthetic or for limitations as to age of animal for other operations, and many requirements concerning the housing and management of animals. Following recent evidence concerning the welfare of hens, calves and pigs certain housing systems are being prohibited. The use of small crates for rearing veal calves is now illegal in Switzerland, Sweden and the United Kingdom and is likely to be banned in the whole of the European Community soon. Stalls and tethers for pregnant sows are banned in Switzerland, Sweden and the United Kingdom and the use of tethers is being phased out in the whole European Community. The small battery cage is banned in Switzerland and will shortly be banned in Sweden and probably in The Netherlands.

At the same time that these new laws are being brought into force, laws to restrict imports of animal produce unless there has been acceptable slaughter, transport and housing are under consideration. These laws are already starting to affect non-European countries who export to Europe. For example, laws concerned with improving animal welfare, as well as those concerned with meat hygiene and quality are affecting the procedures used in slaughterhouses in non-European countries. Another effect on countries outside Europe is a moral one. People in Japan, North America, Australia, New Zealand and many other countries are not happy to be thought of as barbarians because of the way in which they treat animals. Neither are they pleased to be told by Europeans that in the area of world progress which relates to the humane treatment of animals, they are backward countries. The costs of improving animal welfare are not large so the change in attitudes to animals and consequential legislation are sweeping the world rapidly.

## Conclusions

Welfare is a characteristic of an animal which varies from very poor to very good and which can be measured.

The term stress is best used for poor welfare in which the effects on the animal are adverse in that there is reduced fitness or clear indications that fitness will be reduced.

Welfare is also poor when the individual has difficulty in coping with its environment. It is good when an individual has effective control over the factors which affect its life. The welfare of an individual is its state as regards its attempts to cope with its environment.

Behavioural, physiological, immunological, injury, disease, mortality risk, growth and reproduction measures are all of value in assessing welfare. Behaviour measurements are of particular importance but a wide range of measures should be used.

Suffering is an important aspect of poor welfare but welfare can be poor in the absence of suffering, for example when injured or diseased but asleep, anaesthetized or treated with analgesics, or when the immune system is not working properly.

Sophisticated studies of animal preferences are very valuable guides to how to improve animal welfare. They need to be followed up by designing new conditions based on the preferences and comparing these with existing conditions.

Public pressure concerning farm animal welfare is very great in many European countries. Legislators are influenced by this but depend upon scientific evidence about animal welfare when formulating new legislation. Laws about housing, transport and slaughter are now stricter in all European countries following Council of Europe Recommendations. Recent developments in housing and management include the banning in some countries of veal-calf crates, sow stalls and tethers and battery cages. Other countries are affected by these developments because of trade restrictions and the spread of moral concerns about animal welfare.

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