

Science-based assessment of animal welfare: farm animals

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Summary

Animal welfare is to do with the feelings experienced by animals: the absence of strong negative feelings, usually called suffering, and (probably) the presence of positive feelings, usually called pleasure. In any assessment of welfare, it is these feelings that should be assessed. Because feelings are subjective, they cannot be investigated directly. However, there are indirect methods by which animals can be 'asked' what they feel about the conditions under which they are kept and the procedures to which they are subjected. These methods involve preference tests, followed up by motivational tests to assess how important the animal's choice is. Measurements of impaired biological functioning, particularly those connected to decreased health and increased physiological stress responses, can provide good corroborating evidence that welfare is compromised.

Keywords

Biological functioning – Fear – Feelings – Frustration – Motivation – Pain – Pleasure – Preference – Suffering – Welfare.

Introduction

As has often been remarked, animal welfare is a term that has arisen in society to express ethical concerns about the quality of life experienced by animals, particularly animals that are used by human beings in production agriculture (38, 40, 45, 87).

The term is therefore not one that expresses a scientific concept. Nevertheless, because the scientific method is used to identify, interpret and implement societal concerns about animal quality of life issues, animal welfare has become established as a scientific field. Indeed the sub-title of the seminal book by Marian Dawkins on animal suffering published in 1980 was 'The science of animal welfare' (21). However, although science can be of enormous help in solving animal welfare problems, readers should remember that the driving force behind this science is society's ethical concern about the quality of life experienced by farm animals. Therefore, we need to keep in mind what the concerns of society are. 'Is it morally acceptable to keep laying hens in battery cages, gestating sows in dry sow stalls and veal calves in crates?' 'Should animals be de-horned, castrated or tail-docked?' These are

questions that are often heard. Science can provide some evidence about these topics, but the questions are fundamentally ethical (40, 45, 75, 82, 84, 87). Moreover, Western European ethical concerns may differ from those in the Middle-East, and these may be different yet again from views held in North America, the Far East or Africa. Even within a single culture, groups approaching animal welfare from different viewpoints tend to emphasise different aspects. For example, a production scientist is likely to place more weight on good production, a veterinarian on the animal being healthy, a behavioural scientist on the animal being able to perform a wide range of behaviour, and so on. When applying science to the assessment of animal welfare, it is important to keep all these considerations in mind.

What is animal welfare?

Most people from developed countries have a very similar conception of what animal welfare is. This can be revealed

by asking them to give examples of animals with poor welfare. When a wide variety of people are asked this question, they respond with a remarkably similar list of examples. The list includes animals that are ill, injured, in pain, hungry, thirsty, neglected, frightened, frustrated, deprived or bored (30). People have more difficulty giving examples of animals with good welfare. Sometimes they suggest that if none of the previously mentioned welfare-reducing states is present, then this may represent good welfare. Young children often use words like 'happy' or 'contented' to describe animals in good welfare, but these terms are generally avoided by older people (30).

Unfortunately, the ease with which people can produce a list of welfare-reducing states does not mean that 'animal welfare' can be easily defined in scientific terms. In 1983, Marian Dawkins and I reviewed the whole field of published papers in animal welfare science and concluded that it was impossible to give welfare a precise scientific definition (32). We suggested that a broad working description of 'welfare' would include the notions of the animal in complete mental and physical health, the animal in harmony with its environment, the animal being able to adapt without suffering to an artificial environment provided by human beings, and that somehow the animal's feelings should be taken into account. We also suggested that a broad working description of 'suffering' would be 'a wide range of unpleasant emotional states' (32). More recently, others have reached the same conclusion that no precise scientific definition of animal welfare is possible (41, 43). It should be noted that the broad working description of animal welfare given above includes both the physical side of welfare and the mental aspects of subjective feelings.

For a period, this broad description of 'animal welfare' worked quite well. When scientists investigated a variety of putative welfare problems, they saw advantages in using a range of physiological and behavioural indicators of welfare (6, 55, 67, 90). However, as the number of investigations into welfare increased, examples emerged in which some of the descriptors of reduced welfare seemed to contradict one another. For example, does an animal that is behaving normally but has sub-clinical disease have good welfare or reduced welfare? What conclusions should be drawn about a sow in a dry-sow stall that is performing stereotyped movements but is healthy and physiologically normal (89)? What about an animal such as a male rat (86) or a stallion (13) that is showing a physiological stress response because it is voluntarily participating in mating activity? Do these animals have good welfare or reduced welfare?

This non-conformity of the evidence led to a protracted debate within the animal welfare research community, with two distinct schools of thought emerging. One group suggested that welfare is mainly to do with the animal's physical health and well-being. The other group proposed

that welfare is more to do with psychological health and how the animal feels. These two groups have become known as the 'biological functioning' school and the 'feelings' school (31).

The biological functioning school

The biological functioning school believes that welfare is closely connected with the absence of a physiological stress response, or at least with the absence of a large stress response (5, 9, 11, 96). Another tenet of the biological functioning school is that, in order to maintain good welfare, the animal should be able to 'cope' with its environment (11, 39). Finally, this school believes that, for good welfare, the animal must be able to satisfy its biological needs (14, 53).

Intuitively, linking welfare with lack of a stress response makes sense. Earlier papers on welfare assumed that an animal that was not showing a physiological stress response would have good welfare and an animal that was showing a significant stress response would have poor welfare (4, 12, 46, 97). However, as previously stated, these assumptions were subsequently shown not always to hold true; sometimes animals that appear to be distressed show no stress response (89) and sometimes animals do show a stress response when engaging in a rewarding activity (13, 86). Therefore, the early hope of being able to assess welfare simply by taking some measurement of the physiological stress response has not been fulfilled (78).

The concept of 'coping' is also unclear. The problem with this term is that its use suggests that the word is explaining something, whereas, in fact, it is not. Saying that an animal is not coping certainly means that its welfare is compromised and, if nothing is done, the animal will die (56). However, the converse is not true. We can draw no conclusions about the welfare of an animal that is coping, or is having difficulty coping. For example, turkeys adapt to pain from lesions in their hips by sitting more than is normal. Regardless of whether this behaviour is interpreted as 'coping' or not, the birds' welfare would appear to be compromised (35).

The biological functioning school has also proposed that an animal's welfare is affected by a hierarchy of biological needs, and that these can be classified in order of importance as life-sustaining needs, health-sustaining needs and comfort-sustaining needs (53). For example, water is a life-sustaining need: lack of water will reduce welfare, and if water deprivation is prolonged, the animal will die. The fulfilling of health-sustaining needs is somewhat less important for maintaining welfare. If

comfort-sustaining needs are not met, welfare is also reduced, but not so severely as when life-sustaining or health-sustaining needs are not fulfilled. This proposition seems to make good sense. However, when the argument is examined in more detail, it appears that although some needs are essential for life, there is no obvious reduction of welfare if they are not met. For example, in the terrestrial mammals and birds, lack of oxygen is not accompanied by a physiological stress response, by behavioural indicators of stress or by any obvious signs of suffering. The animal simply subsides into unconsciousness (72). It is hard to argue that welfare is reduced in such a case.

Another, very similar scheme involving a hierarchy of needs has been proposed (14). In this case the most important aspects are physiologic needs, followed by safety needs and behavioural needs. However, the same criticism can be made of this scheme: even if some physiologic needs are not met, this lack is not necessarily accompanied by any other accepted indicators of reduced welfare.

The feelings school

In early criticisms of animal use on welfare grounds, for example by antivivisectionists, much emphasis was placed on the role of suffering in reducing welfare (69). In spite of a lingering Cartesian influence, animals (at least mammals and birds) were seen by a significant minority of Western society as sentient beings capable of a range of feelings. Similarly, Ruth Harrison, in her seminal book *Animal machines*, put great emphasis on the suffering of animals when she criticised industrialised animal agriculture in 1964 (48). The Brambell Committee, established by the British government to investigate the allegations in Ruth Harrison's book, also acknowledged the role of mental processes in reducing welfare (8). It stated: 'welfare is a wide term that embraces both the physical and mental well-being of the animal. Any attempt to evaluate welfare, therefore, must take into account the scientific evidence available concerning the feelings of animals that can be derived from their structure and functions and also from their behaviour' (8).

The idea that feelings are an important component of welfare was given more scientific credibility by Marian Dawkins in her book *Animal suffering*, published in 1980 (21). Thereafter, the idea was developed that not only were feelings an important component of welfare (26, 32), but they were possibly the only thing that mattered (28, 29, 31, 37).

The feelings school believes that welfare is all to do with what the animal feels: with the absence of strong, negative, subjective, emotional states that are often lumped together

as 'suffering', and that include such states as pain, fear, frustration, deprivation and, in some species, boredom (31, 32, 58, 93). Welfare may also be associated with the presence of positive emotional states that are commonly called 'pleasure' (30). It is not possible to be more definite about the role of pleasure, simply because there has been so little investigation of pleasure in animals (61).

It has long been recognised that feelings have evolved as a means of protecting the primary needs of animals in a more flexible way than would be possible by reflexes (30, 76). Thus, simple invertebrate organisms can live and reproduce successfully, using simple reflex mechanisms to escape from danger, whereas the vertebrates and more complex invertebrates have evolved the feeling of fear as a more flexible means of avoiding danger.

There is now growing acceptance among animal welfare scientists, even those of the biological functioning school, of the importance of feelings in determining welfare (10).

Assessing welfare

The biggest advantage of assuming that welfare is determined by good biological functioning and the satisfaction of primary needs is that the variables involved are substantive and fairly easily measurable. Feelings, on the other hand, are poorly defined, impossible to measure directly, and difficult to measure indirectly. This probably accounts in part for the resistance of the biological functioning school to the idea that welfare is all about feelings. Science should be objective when assessing welfare, and measuring biological functioning ensures objectivity. The other reason why many behavioural scientists have been reluctant to consider feelings in their welfare research is the antagonism to this topic left behind by behaviourism, a school of North American psychology that was strongly opposed to paying any attention to feelings or consciousness (31). However, in the last quarter of the 20th Century, the grip of behaviourism slackened, and there has been a growth of literature on the topic of feelings (15, 47, 70, 74).

In spite of the obvious difficulties of measuring feelings, if it is feelings that govern welfare, then it is feelings that should be assessed. The problem with a feeling is that it is a subjective state, and therefore is only available to the animal experiencing it. Only I know what I feel, whether it is fear or hunger or happiness. With regard to human beings, we are all built similarly, and so we can argue by analogy and homology that what you feel when you stub your toe is probably similar to what I experience when I stub my toe. Moreover, we have language and so we can describe what we feel to each other. It turns out, in very general terms, that human beings seem to have fairly similar feelings in response to similar circumstances.

But what can we conclude about animals? They are built rather differently, and humans have no common language with animals so they cannot tell us directly how they feel. Nevertheless, great progress is being made in understanding the communication systems of many species and this may open a window on their feelings. For example, the vocalisations of piglets have been analysed in great detail during various painful and anxiety-inducing procedures, and have been shown to give a reliable indication of the piglets' level of distress (88, 91, 92).

It is also fortunate that in investigating feelings in order to assess welfare, researchers do not need to know exactly what the animal is feeling. Thus, in an investigation into possible pain associated with the tail-docking of lambs, it is not necessary to know whether the lamb's experience is similar to what a human being experiences with a deep cut, or a badly stubbed toe, or a severe burn or whatever. In order to assess welfare, it would be extremely helpful to know whether the lamb has a negative experience, how negative the experience is, and how long the negative experience lasts. This type of information can be gathered indirectly.

Methods of assessing welfare

The starting point for an investigation into feelings is usually some type of preference test. The animal is allowed to choose between certain aspects of its environment, and the assumption is that the animal will choose according to how it feels, that is, in the best interests of its welfare. This technique was developed by Barry Hughes and Marian Dawkins, both working with poultry (18, 19, 20, 50, 51, 52). Preference testing is not straightforward, and the various problems associated with it have been discussed in detail (23, 25, 27, 42).

The first objection to preference tests is that an animal's preference may be affected by its previous experience. Although this is certainly true, the situation is no different from many other branches of biology. Moreover, this variable can be controlled fairly easily; researchers can ensure that animals being subjected to preference tests have had similar experiences or can include previous experience as an experimental variable in the preference test.

A second, and thornier, problem is that the results from such experiments can give only relative information. This makes the interpretation of results rather difficult. Thus, if human beings are given a choice between tea and coffee, they may consistently choose in one direction. However, that does not mean that their welfare would be adversely affected if they were forced to take the less-preferred choice. Similarly, if given a choice between two aversive conditions, say being injected in the upper arm or the backside, they may once again choose consistently, but this

time their welfare will be reduced (slightly) by either choice. In addition, minority choices are difficult to interpret. If an animal is given a choice between two conditions A and B, and it chooses to spend 80% of its time in A and 20% in B, how should this be interpreted? The time spent in B is probably a positive choice (since the animal could avoid B completely if it found that condition aversive) and important for the animal's welfare.

There are ways to overcome these difficulties of interpretation. The first is to give as wide a range of choices as possible. The preferences will, of course, still be relative to each other, but this precaution should reduce the possibility of an animal simply choosing a more preferred luxury or the lesser of two evils. In addition, preference testing should be followed up with motivational testing to measure the strength of the preference, and this will be discussed later.

A third problem with preference tests is that there may be a conflict between short-term and long-term welfare. In these cases, animals will tend to choose in the direction of improving or protecting their short-term welfare. For example, meat chickens have been selected to such an extent for large appetites that broiler breeders, the parent stock of the broilers themselves, will over-consume food if given free access to it. The over-consumption leads to their long-term welfare being reduced through obesity, reduced reproductive fitness and increased morbidity (73). Broiler breeders are therefore kept on very severe food restriction in order to protect their long-term welfare. However, this severe food restriction of broiler breeders itself reduces welfare (62). The same has been shown to hold true for tethered gilts that are also kept on a very severe food restriction (2). If dairy cows were given a choice between a ryegrass sward and a lush red clover sward to graze, they would undoubtedly choose the clover, although this might lead to bloat and reduced welfare. A preference test gives information on the current feelings of the animal. This information is important, but it has to be used in conjunction with available knowledge on the long-term risks to welfare of a particular course of action. The human caretaker must make these decisions; the animal should not be expected to weight up the long-term consequences of its decisions and make rational choices that will protect its long-term welfare (25). Even human beings are often unable to make good choices for their long-term welfare; society should not expect animals to do so.

A fourth problem with preference tests is that animals can be fooled with, for example, non-nutritive substances like saccharine, and also with addictive drugs like alcohol or nicotine. The solution is to give animals sensible choices that take into account their natural history.

Preference testing is only the first step in 'asking' an animal what it feels about its environment. It is also essential to

know how important a particular choice is for the animal. A consistent choice might still be a trivial choice, where welfare would not be affected if the animal were forced to accept the less-preferred alternative. Likewise, a consistent choice might be a choice for 'the lesser of two evils', with welfare being adversely affected by both alternatives. It is therefore necessary to follow up preference tests with some measure of preference strength. This can be done by finding out how hard the animal will work or what price it will pay to gain access to its preferred choice. As can be seen from the terms used here – such as 'work', 'price' and 'pay' – an economic analogy is often used in these studies. Economics is the study of how people behave when their incomes change and when the prices of commodities change. These studies can indicate how highly people value certain commodities. One common approach is to use operant conditioning techniques to measure motivation (22, 23). For example, hens can be 'asked' how much they value access to litter by seeing how often they will peck a switch or stand on a switch to open a door that gives access to litter (24). Obstruction testing, in which the animal has to push open a weighted door (34, 59) or pass an obstruction (68) to reach the preferred goal, is another commonly used method.

The various pitfalls associated with motivational testing have been discussed in detail (42). It has long been recognised that there is benefit in using a variety of measures (63) and the better studies do exactly this (59).

In general, tests in which an animal is making a positive choice and working to gain access to a commodity are more straightforward than tests in which the animal is working to avoid some aspect of its environment. However, tests to measure tendency to avoid have also been developed. These include tests for avoiding painful or stressful situations in sheep (77), tests for avoiding frightening situations in domestic fowl (80, 81) and rainbow trout (98), and tests for avoiding certain gaseous environments in poultry (71) and in pigs (54).

Another way in which the value of a resource to an animal can be assessed is by manipulating 'income' rather than changing the 'price' of the resource. The time that an animal has to perform all its various activities can be regarded as 'income', and can be decreased until there is insufficient time for the animal to perform its full repertoire of behaviour. The assumption is that less important activities will drop out first while essential activities will be maintained. However, only a few studies (36) have used this approach.

The experimental techniques so far discussed are good for investigating what the animal might want in its environment. So these techniques can be used to identify particular components or qualities of the physical and social environment that are valued by the animal, either for

their own sake or because they allow the animal to perform particular behaviour patterns (3, 18, 19, 20, 49, 50, 51, 52). These methods are therefore useful in investigating physical and behavioural needs and states of suffering such as deprivation and frustration. These methods can also be used to identify aversive factors in the environment, or management practices that cause fear or some other aversion (54, 71, 77, 80, 81, 98). However, these techniques are not very well suited to investigating pain, and pain is the state of suffering that probably reduces welfare the most in animal agriculture, and on a huge scale.

The possibility of pain is everywhere in animal agriculture. Many surgical interventions are carried out without analgesic or anaesthetic cover, such as castration of calves, piglets, lambs and kids, tail-docking of piglets and lambs, teeth clipping of piglets, de-horning of calves, de-beaking of domestic fowl chicks and turkey poults, and de-snooding and de-toeing of turkey poults. As well as the immediate acute pain associated with these procedures, the healing period is also likely to be painful and there is even the possibility of chronic pain when the healing process is completed. Pain also accompanies injuries such as bruises and abrasions due to badly designed environments. In addition, modern strains of poultry that have been selected for fast growth are showing a high incidence of skeletal disorders (57), many of which are accompanied by pain. There are also other metabolic disorders, such as acidosis in dairy cows, which could be painful. But how do we ask animals if they are in pain?

There are lists of pain symptoms for the farm species, and these are useful, but some are not specific to pain (7). Another approach may be to study an animal's vocalisations to assess the acute pain of a procedure. This has shown promise with regard to assessing pain in piglets (88, 92), but not all farm species may be vocal enough for this to be of use. Another method is to look carefully at the behaviour of animals suspected of being in pain with and without the administration of analgesics (35, 66, 85). However, the most exciting breakthrough in this area has been the recent demonstration that broiler chickens are capable of self-administering a painkilling drug (16). A population of broilers, some of which were lame, were given a choice of two different coloured feeds, one of which contained an analgesic. The lame broilers ate more of the drugged feed than did broilers with no lameness, and ate enough of it to improve their lameness (16). These birds are indicating very clearly that lameness hurts, and if given the chance they will take steps to alleviate it.

In the preceding discussion, great emphasis has been placed on the importance of understanding feelings in assessing welfare. However, when an actual evaluation is being made, although the primary aim should be to assess feelings, all other available evidence should be used as corroboration. This would include evidence of the animal's biological

functioning, and in particular its state of health and state of stress. Thus an animal that is seriously ill may have such feelings of malaise that it becomes impossible for it to take part in any of the tests described above. In this case, common sense should prevail and it should be assumed that the illness itself reduces welfare without necessarily having to prove that the animal is also feeling ill.

When any of the previously described methods have shown that the animal is probably experiencing a negative affective state – in other words, is suffering – additional evidence that the animal is stressed will provide good corroborating evidence. This would include evidence of activation of both the ‘fight or flight’ syndrome, or alarm reaction, and the general adaptation syndrome (64, 65, 83). Although there have been many criticisms of using a stress response as the primary indicator of reduced welfare (17, 31, 78, 79), such a response nevertheless adds power to the argument when used as corroborating evidence. Thus, in an experiment comparing manual and mechanical methods of catching broilers, the birds not only showed more behavioural symptoms of fear when caught manually, but their heart rates showed a more prolonged elevation, indicating that manual catching is more stressful (33). In another study, in which the responses to castration by use of tight rubber rings were compared in lambs, kids and calves, good correspondence was found between behavioural indicators of distress and physiologic measurements of stress (60).

In the past, one of the drawbacks of including stress measurements in welfare studies was that the procedures for taking the measurements, such as blood sampling or attaching electrodes to the animal, tended to be stressful in themselves. However, these methods have been superseded by much less invasive procedures. For example, radiotelemetry offers the possibility of recording physiological variables, such as heart rate and blood pressure, at a distance with minimal interference to the animal (1). Moreover, it is now possible to take glucocorticoid measurements from samples of saliva, urine and faeces (94).

So far, this discussion has dealt exclusively with assessing decrements to welfare caused by various states of suffering such as deprivation, frustration, fear, pain and, in some species, boredom. It should also be borne in mind that animals may be capable of experiencing other states of suffering, not experienced by human beings. These may be more difficult to recognise. However, if we are aware of the possibility of their existence and are constantly on the lookout for them, then we should be able to identify and investigate these states as well.

There is no doubt that the greatest improvements to animal welfare will result from eliminating or at least reducing the amount of suffering experienced by farm animals. But is welfare simply the absence of suffering? There is a growing

opinion that welfare should be more than this (61). In human affairs, we know that pleasure adds enormously to the quality of life, and it is likely that animals are no different. However, there has been very little investigation into states of pleasure in animals. The hypothesis has been put forward that positive and negative feelings may have evolved to solve rather different problems (44). Negative feelings may have evolved to solve ‘need situations’ where there is an immediate threat to fitness from not performing certain behaviour (drinking when thirsty, fleeing when a predator approaches, etc.). Positive feelings, on the other hand, may have evolved to motivate certain behaviour in ‘opportunity situations’ in which all the animal’s essential needs are already taken care of, and the cost of performing the behaviour is low (the pleasure of social grooming or playing, for example). There is some evidence that dust-bathing in domestic fowl, previously thought to be a need-driven behaviour pattern that would result in negative feelings if prevented, actually occurs in ‘opportunity situations’ and leads to a state of pleasure (95).

Conclusions

This paper has argued that animal welfare is primarily to do with the feelings experienced by animals, by the absence of negative feelings known as states of suffering and (probably) by the presence of positive feelings known as states of pleasure. Therefore, in any assessment of welfare it is these feelings that must be measured. However, these feelings are subjective and cannot be accessed directly. Fortunately, there are indirect methods by which we can ‘ask’ animals what they feel about the conditions under which they are kept and the procedures to which they are subjected. These methods include preference tests in which the animal is allowed to choose some aspect of its environment, on the assumption that the animal will choose in the best interests of its welfare. This must be followed up by motivational tests to measure how important the animal’s choice is.

Measurements of impaired biological functioning, particularly those connected to increased physiological stress responses, can provide good corroborating evidence that welfare is compromised. The methods described in this paper have been developed in order to increase our fundamental understanding of animal welfare; different methods may be required to assess welfare on the farm or production unit. To date, most welfare research has been concerned with identifying various states of suffering with a view to eliminating them in animal production. However, there is an emerging view that welfare is more than simply the absence of suffering, and future studies may have to start examining states of pleasure with a view to promoting these states in farm animals. ■

Évaluation scientifique du bien-être animal appliquée aux animaux d'élevage

I.J.H. Duncan

Résumé

Le bien-être animal renvoie aux sensations éprouvées par les animaux : absence de sensations négatives fortes, généralement regroupées sous le terme de « douleur » et (probablement) présence de perceptions positives, habituellement appelées « plaisir ». Toute évaluation du bien-être doit reposer sur l'appréciation de ces sensations qui, compte tenu de leur subjectivité, ne peuvent pas être sondées directement. Il existe néanmoins des méthodes indirectes permettant « d'interroger » les animaux sur leur ressenti concernant leurs conditions de maintenance et les manipulations auxquelles ils sont soumis. Ces méthodes comportent des tests de préférence suivis par des tests de motivation visant à évaluer l'importance du choix effectué par l'animal. Les épreuves visant à mesurer les perturbations du fonctionnement biologique, en particulier celles qui sont liées à une dégradation de l'état de santé et à une augmentation de la réponse au stress physiologique, peuvent être un bon outil pour confirmer l'existence d'une atteinte au bien-être.

Mots-clés

Bien-être – Douleur – Fonctionnement biologique – Frustration – Motivation – Peur – Plaisir – Préférence – Sensations – Souffrance.



Evaluación por métodos científicos del bienestar de los animales de granja

I.J.H. Duncan

Resumen

El bienestar animal tiene que ver con las sensaciones experimentadas por los animales, esto es: la ausencia de fuertes sensaciones negativas, llamadas en general "sufrimiento", y (probablemente) la presencia de otras positivas, que suelen denominarse "placer". Toda evaluación del grado de bienestar animal debe centrarse en la medición de estas sensaciones. Pero dado que son subjetivas, no es posible estudiarlas directamente. Existen sin embargo métodos indirectos para "preguntar" a los animales cómo se sienten respecto a sus condiciones de vida y a los procedimientos que se les aplican. Dichos métodos entrañan la realización de pruebas de preferencia, seguidas de pruebas de motivación para evaluar cuán acusada es la preferencia del animal. Las medidas de incorrecto funcionamiento biológico, sobre todo las vinculadas a problemas de salud o al aumento del estrés fisiológico, pueden aportar pruebas confirmatorias de que el bienestar de un animal está en peligro.

Palabras clave

Bienestar – Dolor – Frustración – Funcionamiento biológico – Miedo – Motivación – Placer – Preferencia – Sensaciones – Sufrimiento.



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