

The Welfare of Laboratory Animals

Animal Welfare

VOLUME 2

Series Editor

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The Welfare of Laboratory Animals

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Animal Welfare by Species: Series preface

Animal welfare is attracting increasing interest worldwide, but particularly from those in developed countries, who now have the knowledge and resources to be able to offer the best management systems for their farm animals, as well as potentially being able to offer plentiful resources for companion, zoo and laboratory animals. The increased attention given to animal welfare in the West derives largely from the fact that the relentless pursuit of financial reward and efficiency has led to the development of intensive animal production systems that offend the conscience of many consumers in those countries. In developing countries, human survival is still a daily uncertainty, so that provision for animal welfare has to be balanced against human welfare. Welfare is usually provided for only if it supports the output of the animal, be it food, work, clothing, sport or companionship. In reality there are resources for all if they are properly husbanded in both developing and developed countries. The inequitable division of the world's riches creates physical and psychological poverty for humans and animals alike in all sectors of the world. Livestock are the world's biggest land user (FAO, 2002) and the population, particularly of monogastric animals, is increasing rapidly to meet the need of an expanding human population. Populations of animals managed by humans are therefore increasing worldwide, so there is the tendency to allocate fewer resources to each one.

The intimate connection between animal, stockman and consumer that was so essential in the past is rare nowadays, having been superseded by technologically efficient production systems where animals on farms and in labs are tended by fewer and fewer humans in the drive to increase labour efficiency. Consumers also rarely have any contact with the animals that produce their food. In this estranged, efficient world man struggles to find

the moral imperatives to determine the level of welfare that he should afford to animals within his charge. Some aim for what they believe to be the highest levels of welfare provision, such as the owners of pampered pets, others deliberately or through ignorance keep animals in impoverished conditions or even dangerously close to death. Religious beliefs and directives encouraging us to care for animals have been cast aside in a supreme act of human self-confidence, stemming largely from the accelerating pace of scientific development. Instead, today's moral code derives as much from horrific tales of animal abuse portrayed in the media and the assurances that we receive from supermarkets that animals used for their products were not abused in this way. The young were always exhorted to be kind to animals through exposure to fables whose moral message was the benevolent treatment of animals. Such messages are today enlivened by the powerful images of modern technology, but essentially still alert children to the wrongs associated with animal abuse.

This series has been designed to provide academic texts discussing the provision for the welfare of the major animal species that are managed by humans. They are not detailed blue-prints for the management of animals in each species, rather they describe and consider the major welfare concerns of the species, often in relation to similar species or the wild progenitors of the managed animals. Welfare is considered in relation to the animal's needs, concentrating on nutrition, behaviour, reproduction and the physical and social environment. Economic effects of animal welfare provision are considered, and key areas requiring further research.

With the growing pace of knowledge in this new area of research, it is hoped that this series will provide a timely and much-needed set of texts for researchers, lecturers, practitioners, and students. My thanks are particularly due to the publishers for their support, and to the authors and editors for their hard work in producing the texts on time and in good order.

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Reference: Food and Agriculture Organisation (2002).

http://www.fao.org/ag/aga/index_en.htm.

Preface

Laboratory animals are important tools in biomedical research to investigate such vital issues as the ontogeny and ageing of mammals, mechanisms of diseases and their prevention or treatment, or health risks in our living environment. In 1999, 9.7 million animals were used in experiments (including 8.7 million mammals) in the European Union member states. They were mostly mice (5.3 million), rats (2.6 million), guinea pigs (0.29 million) and rabbits (0.23 million). Of the larger animal species, 66000 pigs, 22 000 dogs and 7000 primates were used in the same year in the 15 EU member states.

The welfare of laboratory animals is perhaps one of the most distrusted issue concerning animals under human control. The discussion about rights and ethics of animal use is of paramount importance to scientist, authorities and lay people. The use of laboratory animals is strictly regulated by legislation, and the numbers of animals used in research is the subject of intense scrutiny. Today, the principles of 3 R's (Reduction, Refinement and Replacement) are accepted to be the main guide for the use of laboratory animals. Moreover, a lot of research focuses on the welfare issues concerning the maintenance and use of laboratory animals, searching for better alternatives to husbandry routines, experimental techniques, as well as alternatives to animal research. This has led to several principles, guidelines and recommendations, the goal being to ensure the welfare of animals and the reliability of research.

The welfare of laboratory animals includes two main issues: one is their breeding and general maintenance, the other is their handling during experimental procedures. Breeding includes strict control of the genetics, at least with rodents. In the maintenance of laboratory animals, the

standardisation and elimination of confounding factors like pathogens are the main principles by which the scientific reliability of experiments is ensured. This means many restrictions on the environment of laboratory animals. They have to eat only a standardised diet, live on the same bedding material, under a regular light rhythm etc., in the facilities with very high hygienic control. Meanwhile, their welfare is preserved as far as possible by enrichmental tools and appropriate care routines, the main goal being that the species specific ethological needs are fulfilled. In experiments, appropriate methods must be used when procedures such as administration of substances, sampling of tissues, anaesthesia and euthanasia are carried out. These procedures should not confound the experimental results and the welfare of animals must be ensured as far as possible. Training and education of personnel undertaking these procedures are important to ensure a good science.

This book has two main parts: part one focuses on the general principles of laboratory animal maintenance and experimental use, as well as factors which have to be taken into account when good research is done with animals. The second part is species specific, concentrating on the species most used as laboratory animals. This part gives a comprehensive description of the welfare questions considered to be important for each species under laboratory conditions.

The authors of this book are leading European scientists in laboratory animal science. I wish to thank all of them for their valuable contribution of this book. The pervading theme of the book is that animal welfare can be enhanced by giving the animals safe living environment which fulfils the species specific needs. The living environment should be without severe stress though the environment should be variable enough to help animals to cope with different challenges when they are taken into the experiment. Indeed, the welfare of laboratory animals should be under continuous evaluation, and the one goal should be it's improvement as far as possible.

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GENERAL PRINCIPLES FOR MAINTENANCE
AND USE OF LABORATORY ANIMALS

Chapter 1

ANIMAL WELFARE - AN INTRODUCTION

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1. INTRODUCTION

“Why even bother?” Perhaps this is the first question we should ask, when we begin to address the issue of animal welfare. If we do not have any moral or ethical obligations toward animals as pertains to their welfare, there is no reason to consider whether their welfare is good or bad. On the other hand, if we do have such moral obligations, we need to be able to assess the welfare of the animals we work with.

The fundamental assumption in this chapter is that we indeed have a moral obligation to ensure the welfare of animals, and therefore we need ways to evaluate how the animals we work with are faring. A lot of different views and theories exist on the nature of animal welfare, but despite decades of committed work, no final definition has been agreed upon.

Scientists have often tried to define animal welfare in a way which already contains the answer as to how it can be measured. However, agreeing on the nature of animal welfare does not require us to define it like we would define any technical term such as hyperglycemia or hypoplasia, but rather it requires agreement on the basic values that contribute to the well-being of the individual animal (Tannenbaum 1991, Duncan and Fraser 1997). Any conceptualization of animal welfare inherently involves values because it pertains to what is better or worse for the animals. The different research approaches and interpretations that scientists use in assessing animal welfare often merely reflect such value-laden presumptions (Fraser et al. 1997).

So the philosophical question considering which basic values matter most, must be solved before animal welfare can be assessed. If our assumptions on the nature of animal welfare are implicit or perhaps even unclear, we can't be certain that we are asking the right questions, and we certainly can't be sure that we are asking them the right way.

The question of how to measure animal welfare, however, is not a philosophical one but a scientific one, whereas the overall evaluation and interpretation of the results of these measurements calls for both a philosophical and a scientific approach.

The nature of animal welfare falls into one of two categories. Either the basic values are objective, such as good biological functioning or the possibility to perform natural behaviours. These values can be assessed using measures such as reproduction rate, disease prevalence, cortisol levels and occurrence of stereotyped behaviours.

Alternatively, the basic values may be subjective in nature, relating to the inner mental state of the animal, such as feelings and preferences. As we are not yet able to see what's going on inside the animal's head, these values cannot be directly measured. However, evaluating certain behaviours of the animal may provide an indirect measure of these feelings and preferences.

2. DEFINING ANIMAL WELFARE IN TERMS OF PREFERENCES AND FEELINGS.

2.1 Preference theories (or desire-fulfilment theories)

Preference theory (Success theory) holds the notion that the level of welfare relates directly to having desires or preferences fulfilled. The welfare of an animal depends on the satisfaction of preferences - a more preferred environment results in a higher level of welfare (Jensen and Sandøe 1997). This theory, originally relating to human well-being, raises a central question which becomes even more obvious when working with animals: Does it contribute to an individual's welfare to have its desires met, even if the individual does not experience it? Intuitively it does not – if you do not realise that an important desire has been fulfilled, it will not change your situation – you have to experience the fulfilment of a preference for it to influence your welfare. Sandøe (1996) expresses this criterion of experience in his version of the experienced preference satisfaction theory: *“A subjects welfare at a given point in time (t1) is relative to the degree of agreement between what he/it at t1 prefers (is motivated to do, wants, aspires after, hopes for, does not try to avoid or is not indifferent to getting)*

and how he/it at t1 sees his/its situation (past, present and future) - the better agreement the greater welfare”.

Sandøe states that it is important that you experience the fulfilment of your preferences and that your preferences are fulfilled, while you still have them. In other words, your preferences must exist in the present if fulfilment should result in increased welfare. But this theory also calls for the individual's ability to judge its own situation – both with regard to the past, the present and the future. It can be argued that animals are not capable of such judgements regarding the past and the future, and hence they have no long-term preferences. As discussed below, preference studies support the idea that animals do not experience or at least do not consider long-term preferences.

2.2 Hedonism

2.2.1 Narrow hedonism

Hedonism deals with feelings and mental states that matter to the animal. According to the hedonistic approach, good welfare consists of a life-long presence of pleasant mental states and, just as important, the absence of unpleasant mental states (Appleby and Sandøe 2002). The more pleasant feelings and the fewer unpleasant ones, the better welfare (Jensen and Sandøe 1997).

Several scientists have agreed that feelings are what matters in animal welfare. For example, Dawkins (1990) writes: *“Let us not mince words: Animal welfare involves the subjective feelings of animals.”* And Duncan (1996) concludes that: *“It is feelings that govern welfare and it is feelings that should be measured in order to assess welfare”* as well as *“...sentience, in other words feelings, is what welfare is all about”.*

2.2.2 Preference-hedonism

The problem with the above mentioned hedonistic view – the so-called narrow hedonism – is that it is difficult to agree on which feelings are positive and which are negative, and to which extent they count. Moreover, different feelings may not have a basic common inherent quality, which makes it very difficult to compare different feelings. One promising way of dealing with this problem is to accept the claims of preference-hedonism, as expressed by Parfit (1984): *“Narrow hedonism assumes, falsely, that pleasure and pain are two distinctive kinds of experience. Compare the pleasures of satisfying an intense thirst or lust, listening to music, solving an intellectual problem, reading a tragedy and knowing that one's child is*

happy. These various experiences do not contain any distinctive common quality. What pains and pleasures have in common are their relations to our desires. On the use of "pain" which has a rational and moral significance, all pains are when experienced unwanted, and a pain is worse or greater the more it is unwanted. Similar, all pleasures are when experienced wanted, and they are better or greater the more they are wanted. These are the claims of Preference-Hedonism. On this view, one of two experiences is more pleasant if it is preferred."

Coming back to the experienced preference satisfaction theory of Sandøe, it should be noted that although this theory is a variant of success theory, it allows room for having preferences for certain feelings, which again relates it to the theory of preference-hedonism.

When working with animal welfare, preference-hedonism seems to be a good starting point. Preference-hedonism appeals only to desires about one's present state of mind (Parfit 1984), and animals most likely do not have long-term preferences or preferences regarding the past.

2.2.3 Measuring feelings

Animals' feelings are very difficult to measure, which make the hedonistic view hard to work with on a practical level. However, if we assume that an animal would prefer situations which are linked to pleasant feelings, and avoid situations arousing negative ones, we can indirectly assess feelings by measuring the preferences of the animal.

2.2.4 Measuring preferences

Measuring an animal's preferences can be done in a strictly scientific way, as demonstrated below. However, it is worth noting that it is difficult – if not impossible – to discern whether an animal acts the way it does due to certain preferences or because preferences are merely a means to reach a certain goal, namely the preferred mental state.

Preferences can be assessed using tests such as choice tests or operant tests. In a choice test, an animal must choose between two or more resources (stimuli) provided to the animal by the researcher. In an operant test, an animal is trained to perform a simple response (e.g. pressing a lever) in order to obtain something good – a positive stimulus. If the animal is motivated to obtain the stimulus, it will work for the stimulus. The more important the stimulus is to the animal, the harder the animal will work to obtain it. In choice tests there is also an element of work, since the animal has to decide on for instance going from A to B, when making a choice, but it is not

possible to assess the strength of a certain preference to the same extent as when using operant tests.

In a preference test, the animal is thus presented with a choice of certain environmental factors, and it is assumed that the animal will choose according to its preferences, and that these choices will be made in the best interest of its own welfare (Duncan 1992). However, the answer is not so straightforward. Using preference testing to assess animal welfare calls for caution on several points.

2.2.5 Problems of preference testing

First, we do not know for sure what we are testing. In operant preference testing, it is most likely not just the preferences of the animal, but rather the decisions made by the animal on the basis of both preferences and environmental factors, which may influence the amount of work the animal must perform to reach its goal (Sørensen 2001).

Moreover, a preference test tends to only give an idea of the relative properties of the choices given. If the animal is given the choice between two aversive conditions, it may show strong preference for one of the conditions. Nevertheless, the animal's welfare is reduced even by exposure to the "preferred" condition. In the same manner, exposure to two appealing but not essential resources may indicate a strong preference for one, but actually the lack of both resources will not affect the welfare of the animal severely (Duncan 1992).

2.2.6 Animals and long-term preferences

On the assumption that the nature of welfare corresponds with the theory of experienced preference satisfaction as mentioned previously, one particular point must be carefully considered when evaluating animal welfare. Even though animals show anticipatory behaviour (Ladewig et al. 2002, Van der Harst et al. 2003) and are able to anticipate the consequences of a choice over a short time (i.e. seconds) (Abeyesinghe et al. 2003), it often seems as if animals do not consider long-term preferences (preferences on what might be good in the long run (days, weeks or even years) as opposed to instant gratification). Compared to humans, animals are probably less able to think about past and future situations, and therefore there may be lack of agreement between what the animal prefers in a preference test, and what the researcher knows is best for the animal on a long term basis. Broiler breeding stock has been selected for increased growth, and therefore increased appetite, to such an extent that they will become obese if they are allowed free access to food. Even though the resulting obesity will reduce

long-term welfare of the animals, feed restriction will most likely also result in reduced welfare (Duncan 1992). It is also relevant that rodents fed *ad libitum* will have a higher risk of obesity, tumours and a reduced life-span. This corresponds to a situation most people can relate to, namely that fulfilling the preferences of children for eating gummy bears, chips and watching junk cartoons does not improve the child's welfare in the long run, even though the child feels it is all that matters here and now. If children and animals on the other hand are Preference-Hedonists, meaning that it's only fulfilling the present preferences for preferred mental states that counts, then the chickens and the rats as well as the child in the above examples are experiencing good welfare.

However, working with animal welfare, we can not allow ourselves to ignore the importance of long-term effects of the environment on animal welfare. Environmental factors, which we as informed humans, believe or know are important, may prove indifferent to the animal, when tested. For example, to us, locomotion is an important factor in animal welfare - it keeps the animal fit and strengthens the joints and muscles. Pigs in operant preference testing show very little interest in walking for its own sake (Matthews and Ladewig 1994, Ladewig and Matthews 1996). People who jog often do so, because it makes them feel good, probably because they know it will improve their health on the long term. Pigs do not realise that walking in a treadmill may prevent health problems in the future, but if walking is important to pigs, why don't they have build-in preferences to ensure that they keep themselves fit?

The answer probably lies in the way we house our animals. In wild animals factors such as locomotion are an integral part of normal behaviour displays, including foraging, escaping predators, hunting and searching for shelter. Hence the animal does not need any motivation for locomotion *per se*. Evaluation of the result of preference testing therefore must contain a careful judgement of apparent lack of preferences for environmental factors or behaviours obviously important for the welfare of the animal. It is important to realise that if we consider behaviours that the animal is highly motivated to perform (assessed by preference testing), the need for factors having a positive impact on long-term welfare will often be fulfilled in the process. For example, gnawing and chewing behaviours with no consummatory function are often considered an integral part of rat behaviour, but assuming that rats will show gnawing behaviour for no reason at all is - from an ethological point of view - counter-intuitive. Gnawing is a behaviour which will ensure the necessary wear and tear of the teeth of the rodent, but this fact does not mean that rats have built-in preferences for gnawing *per se*. If rats live a varied life in a complex environment, gnawing will be performed as an integral part of different behaviours such as eating,

exploring, gaining access to desirable environments or escaping from aversive ones and probably nest building. Hence, physically-based needs for gnawing are fulfilled in the process of performing behaviours for which the rats are motivated. It would be reasonable to suggest that also in laboratory rats there is a direct purpose of gnawing such as preparing materials for nest-building or trying to gain access to something desirable. Another obvious reason to gnaw would be to try to escape from an aversive environment (Sørensen et al. in press).

It is essential to realise that a preference test only provides information on the current demands of the animal, and these demands must be important to the animal – otherwise the animal would not have worked to obtain them. But since animals cannot be expected to make rational choices, taking into consideration the long-term consequences on their welfare, it is the scientists job to balance the current desires of the animal with the scientific knowledge that tells us which environmental factors the animal will benefit from in the long run.

3. DEFINING ANIMAL WELFARE IN TERMS OF THE NATURE OF THE ANIMAL

3.1 Perfectionism

The theory of Perfectionism states that in order to have a good life one must realise certain genetically-based, species-specific potentials. In other words, the animal must be able to express its nature in order for the animal to live a good life. Rollin (1989) writes: “*We would expect its (the animal’s) behaviour to be appropriate to its telos – the unique, evolutionary determined, genetically encoded, environmentally shaped set of needs and interests which characterise the animal in question – the ‘pigness’ of the pig, the ‘dogness’ of the dog, and so on*”.

One of the main objections to this idea is that often an animal in the wild or in a semi-natural environment expresses behaviours which intuitively does not seem to add to the animal’s welfare while it is expressing this behaviour (for example, escaping a predator). Such behaviours are adaptations that have evolved to enable animals to cope with aversive environments or situations. Critics of perfectionism will say that it is reasonable to assume that an animal under such aversive, or even life-threatening, circumstances has reduced welfare or even suffers, and hence performing the full behavioural repertoire does not necessarily increase the welfare of the animal.

However, even though an animal possesses a set of conditional behavioural patterns that governs the performance of behaviours, it doesn't necessarily mean that the animal must perform these behaviours to enjoy welfare, but rather that the animal should be able to use these mechanisms for adaptation, if the circumstances should require it to (Fraser et al. 1997). So laboratory rodents do not need to run away from cats from time to time to have good welfare, but if a cat appears, the rodent should be allowed to express relevant flight-related behaviour.

3.2 Evaluating “natural” behaviours

To evaluate animal welfare at the basis of Perfectionism demands that we have thorough knowledge on how the animal would behave in a natural environment. Laboratory rodents have been bred by humans for several generations, and furthermore mice and rats are highly adaptive, both factors that may raise doubts as to what really constitutes the true natural behaviour of these species. But the ancestors of our laboratory rodents are still living in the wild, and the study of their behaviour will provide a very good starting point. To further refine the obtained results, laboratory rodents can be studied in environments of variable complexity, preferable similar to those of their ancestors. Last, the study of feral animals, i.e. animals released or escaped into the wild, having adapted to a life without humans caring for them may provide valuable information. These approaches probably will not provide the entire truth, but hopefully it will bring us much closer.

4. DEFINING ANIMAL WELFARE IN TERMS OF THE BIOLOGICAL FUNCTIONING OF THE ANIMAL

Good biological functioning constitutes the basis of a great deal of welfare evaluating methods. The view that the functioning of the animal is what matters is represented e.g. by McGlone (1993), who suggests that “*an animal is in a state of poor welfare only when physiological systems are disturbed to the point that survival or reproduction are impaired.*” Another theory emphasising the need for good biological functioning is the theory of coping: “*The welfare of an individual is its state as regards its attempts to cope with its environment.*” (Broom 1986, 1996).

According to Broom, the attempts to cope and the results of failure to cope can be measured using variables such as mortality rates, disease incidence, reproductive success, severity of injury, extent of adrenal activity

and so on (Fraser and Broom 1990). In other words, the better the animal is able to adapt using its physiological mechanisms, without these mechanisms being challenged beyond their capability, the better the animal's welfare.

The previous problem of preference-testing and long-term preferences would be solved using this approach. If animals are not showing any preferences for resources that they will benefit from in the long run, then their biological functioning may be jeopardised – just like the child eating nothing but chips and gummy bears. So according to this theory feeding on a diet consisting of gummy bears will in fact result in decreased welfare due to impaired biological functioning.

However, this theory raises another problem. Consider an animal whose biological functioning is in fact impaired, but which doesn't experience any resulting negative mental states at all. This would be the case of a vasectomised male rat, used for mating embryo transfer recipient females. The vasectomised male is allowed to perform courtship and mating behaviour, but he can not produce offspring. It seems contra-intuitive that such a rat should experience bad welfare due to impairment of his biological functioning.

5. SCIENTIFICALLY BASED HYBRID VIEWS ON ANIMAL WELFARE

Scientists working with animal welfare seem to agree that accurate assessment of animal welfare should be based on a blend of these different theories. The theory put forward by Broom (1986, 1996) also holds elements of perfectionism in that it is the ability of the animal to function according to its nature that counts. Moreover, Broom also states that the measuring of welfare should include behavioural and physiological indicators of pleasure – thus making pleasure count which is clearly a hedonistic approach (Broom 1996).

A previously mentioned theory on welfare is that of Dawkins (1990). It is based on hedonism, but relates to several other theories. Dawkins (1990) states that: "*Suffering occurs when unpleasant subjective feelings are acute or continue for a long time, because the animal is unable to carry out the actions that would normally reduce risks to life and reproduction in those circumstances.*"

So, suffering originates from not being able to cope by using evolutionary-determined, species-specific behaviours. So far, suffering, and thus poor welfare, relates to hedonism, perfectionism and the biological functioning of the animal. But furthermore, according to Dawkins, not being able to do what you want will result in mental states which negatively

impact on the animal's welfare. Hence not having one's preferences fulfilled will lead to a decrease in welfare. Dawkins (1990) provides this example: *“Wild birds may have little chance of surviving, if they do not migrate, so the caged one (of the same species and well cared for) is behaving ‘as if’ death through failure to migrate were very likely. In other words, the canonical costs (risks to fitness) of not migrating may be very small, but the animal may suffer nevertheless.”*

So in fact, Dawkins' view represents a mixture of many philosophical approaches to the nature of welfare. Such a hybrid view is also presented by Simonsen (1996), whose definition shares qualities with most of the previously mentioned theories. This definition states that: *“Animal welfare consists of the animals' positive and negative experiences. Important negative experiences are pain and frustration and important positive experiences are expressed in play, performance of appetitive behaviour and consummatory acts. Assessment of animal welfare must be based on scientific knowledge and practical experience related to behaviour, health and physiology.”* (Simonsen 1996).

The first part of the definition is truly hedonic in character. Poor welfare originates in negative experiences or mental states such as pain and frustration. The second part involving positive experiences does not mention the positive experiences in themselves, but rather their expression. It is reasonable to assume that the animal would prefer to have the opportunity to perform behavioural patterns such as play, appetitive behaviour and consummatory behaviour, since these behaviours express good welfare. Not being able to perform these behaviours will lead to frustration and hence to reduced welfare (as frustration is a negative mental state). The second part of the definition put forward by Simonsen is therefore related to preference theories. Moreover, the behavioural patterns mentioned by Simonsen, are species-specific normal behaviours. Performing these behaviours is connected to experiencing good welfare, and therefore elements of perfectionism are present.

The five freedoms, as described by Webster (2001) relate to all of the above mentioned theories on animal welfare:

- Freedom from hunger and thirst
- Freedom from physical discomfort and pain
- Freedom from injury and disease
- Freedom from fear and distress
- Freedom to conform to essential behaviour patterns

The first four freedoms all pertain to aversive experiences and thus relates to hedonism. However, it is possible for an animal to be sick without

perceiving it, and still the disease would affect the animal's natural functioning, one of which is reproduction. For example, if a pregnant rat is infected with Kilham rat virus, the infection will not affect the pregnant rat, but if the virus crosses the placental barrier, it may result in abortion or malformations of the developing foetuses. And if an animal is distressed (the fourth freedom), it is most likely experiencing a situation difficult to cope with. In both cases the natural functioning of the animal has been compromised.

The last of the five freedoms clearly relates to Perfectionism – the animal must be allowed to express natural species-specific behaviour to have good welfare. Unfortunately, the formulation is rather vague, failing to define the term “essential behaviour patterns.”

6. CONCLUSION

If the serum level of corticosterone is increased, we conclude that the animal is acutely stressed. The crucial question is then: “Why is an elevated corticosterone level an indicator of poor animal welfare?” Is it because the natural functioning of the animal is jeopardised? Or is it because the animal experiences an aversive situation? Or is it because the animal is not allowed to display its natural behaviour?

Working with animals, scientists have proposed that the assessment of animal welfare should include a mixture of different philosophical theories such as hedonism, perfectionism and preference theories. Intuitively, this holistic approach considering the entire animal is appealing. However, in many cases the conclusion drawn on the basis of a scientific evaluation of animal welfare will depend on how the nature of welfare is defined. Consider a dog having behavioural problems caused by fear of being left alone. The anxiety-related behaviour can be eliminated using psychotherapeutic drugs such as tricyclic antidepressants. The medication enables the dog to be at home alone without showing any signs of fear or anxiety. If the dog is not feeling anxious or frightened then, according to a hedonist, the welfare of this dog is not compromised. And if the dog does not have an unfulfilled preference for company, the preference theoretic does not see any problems, either. However, according to a perfectionist there is a reduction in welfare, since the dog's natural functioning and behaviour is compromised (dogs are pack animals and therefore it is natural for a dog to be anxious when left alone). So there is no simple answer to what constitutes animal welfare. That makes it even more important that, when evaluating animal welfare, the underlying assumptions regarding which values are important for animal welfare are made explicit.

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Chapter 2

RESEARCH, ANIMALS AND WELFARE

Regulations, alternatives and guidelines

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1. INTRODUCTION

High quality of biomedical research and acceptance of animal use overall in science necessitate refined animal welfare. On the legal side, the European Commission (86/609/EEC) states that the EU Member States must actively encourage and support the development, validation and acceptance of methods, which could reduce, refine or replace the use of laboratory animals (3R's).

ESF's (European Science Foundation) 'Use of Animals in Research' statement also strongly endorses the principles of the '3R's'. 'Efforts ought to be taken to replace the use of live animals by non-animal alternatives, to reduce the number of animals used in experiments to the minimum required for obtaining meaningful results and to refine procedures, so that the degree of suffering is minimised. Research aiming at improving the welfare of animals should be encouraged and actively supported (ESF 2001).

Recently started revision of the directive is likely to include cost-benefit analysis for ethical evaluation of animal studies at study level, a development which will undoubtedly emphasize the need for better laboratory animal welfare, both in procedures and in housing (European Parliament 2002).

The answer to all these requirements is obvious: Proper education and training of all involved.

2. EUROPEAN REGULATIONS

Harmonisation of the laws and regulations on use of vertebrate animals in research is the key aim of both the European Directive and the Convention (86/609/EEC, ETS123). These contain articles with almost the same text. The Convention includes Appendix A, housing and care of laboratory animals. This Appendix is experiencing a major revision, which will definitely improve laboratory animal housing and care, and consequently animal welfare.

Article 5 of the Directive and the Convention states general principles of animal care and housing. ‘Any animal...shall be provided with accommodation, an environment, at least a minimum degree of freedom of movement, food, water and care, appropriate to its health and well-being. Any restriction on the extent to which an animal can satisfy its physiological and ethological needs shall be limited as far as practicable’ (ETS123).

Appendix A gives much more detailed guidelines for animal housing. It contains minimum space allocations for all laboratory species, facility requirements and routine animal care procedures. Appendix A is under revision, and the new one includes general and species specific parts, some with scientific basis for guidelines. The revision will increase some of the space requirements; emphasize group housing for all gregarious species and implementation of environmental enrichment. As such, the revised document is much larger than the present one, and it is expected to improve animal welfare (The Council’s Group of Experts on Rodents and Rabbits 2001). A more detailed description of and the basis for the revised Appendix A is presented in another chapter of this book.

Articles 6-12 deal with the procedure to be carried out for scientific purposes. The key message of these articles can be seen in the text of article 7: ‘in a choice between procedures, those should be selected which use the minimum number of animals, cause the least pain, suffering, distress or lasting harm and which are most likely to provide satisfactory results’ (ETS123).

What does it mean being harmonized? And how does harmonization relate to other requirements for animal welfare, ethics and science? In this environment harmonization can and should be seen as the minimum standard, below which nobody is allowed to operate. Well above the minimum standard, there should be an area of excellence, where ideals of ethics and science are the driving forces. This relation is illustrated in Figure 2-1.

Improvement of laboratory animal welfare means good science in the vast majority of cases. Yet, there may be conflicts as well. This possibility is acknowledged in passing in articles of both Directive and Convention of

animals. Article 7 states that the choice of procedures should be selected on the basis of ‘which are most likely to provide satisfactory results’ (ETS123).

The revised Appendix A is clearer on this possibility, and says that for instance single housing or raised area in rabbits can be omitted if there is welfare or scientific reason not to use them (The Council’s Group of Experts on Rodents and Rabbits 2001).

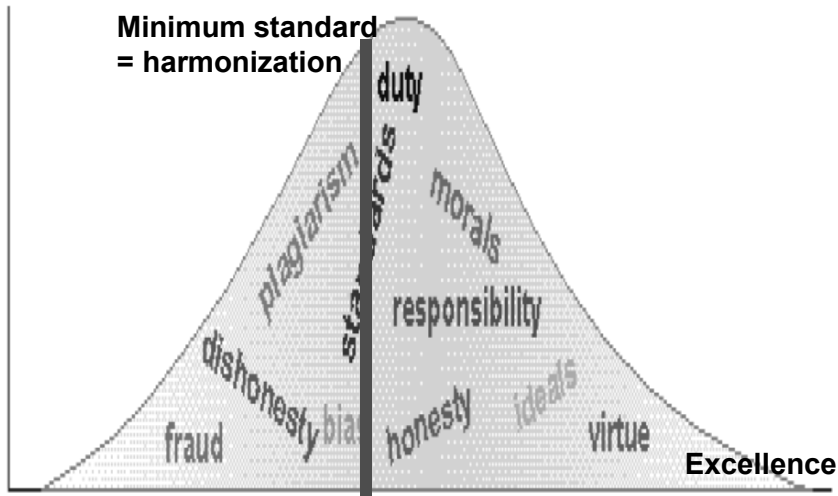


Figure 2-1. Gaussian curve illustrating relationship between harmonization and excellence in all operations, including those aiming at improving laboratory animal welfare.

3. NORTH-AMERICAN REGULATIONS

In the United States, regulations for laboratory animals are included in the Welfare Act, the Public Health Service (PHS) Policy on Humane care and Use of Laboratory Animals, the Guide for the Care and Use of Laboratory Animals, and the U.S. Government Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training.

The U.S. Government Principles state that ‘the living conditions of animals should be appropriate for their species and contribute to their health and comfort’. Overall, the Policy is a large document and intended to implement and supplement those principles. This Policy is a basic requirement for all PHS-conducted or supported activities involving animals. Compliance must be shown through a written Assurance acceptable to the PHS.

The PHS requires facilities to use the Guide as a basis for an institutional program, and through the Guide that those who care for or use animals in research must assume responsibility for their well-being. Each institution must have an Institutional Animal Care and Use Committee (IACUC) to oversee and evaluate the institution's animal program to assure compliance with all the regulations.

The Guide states that 'proper housing and management of animal facilities are essential to animal well-being' and that 'a good management program provides the environment, housing, and care that permit animals to grow, mature, reproduce, and maintain good health; provides for their well-being; and minimizes variations that can affect research results.' Moreover, the Guide endorses housing which maximises species-specific and minimises stress-induced behaviours.

In Canada detailed guidelines for laboratory animal welfare can be found in CCAC (Canadian Council on Animal Care) Guide to the Care and Use of Experimental Animals and CCAC Guide to the Care and Use of Experimental Animals. These documents state that 'In the past, emphasis has been directed towards providing adequate caging for experimental animals in order to contain them hygienically, to facilitate husbandry, and minimise (husbandry) variables. However, increasing importance is now being placed on reducing the animal's stress, and improving its social and behavioural well-being. Provision of varied environmental enrichment may or may not result in increased cost of operation; however, it is considered that there is often immediate benefit to the animal and ultimately to the researcher and the research.'

The Guide emphasises the social needs of animals to have equal importance as environmental factors such as lighting, heating, ventilation and containment (caging). Singly housed animals must be observed daily to provide social contact for the animal and the animal to become accustomed to the human presence.

Whenever single housing is used the protocols must include measures for meeting the social requirements of the isolated animal. Overall, investigators must justify all deviations from the Guide to an Animal Care Committee (ACC) in order to receive approval. All protocols must be reviewed at least annually by the ACC.

4. ALTERNATIVES AND ETHICS

Refinement, Reduction and Replacement (3R's) are all considered alternatives to laboratory animals (Russell and Burch 1959). When replacement is successful, no welfare problems remain, since no animals are