

Ethical guidelines for research in animal science

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1. Introduction

Animal science research is important in relation to our understanding of animals, their function and performance, and their relationships with their social and physical environments. Animal science research covers a wide range of disciplines and so can lead to the use of a variety of experimental techniques on animals for many different purposes. This has the potential to lead to a multitude of diverse ethical issues. Members of the British Society of Animal Science and authors of papers submitted to the Society for publication come from countries around the world and therefore are subject to differences in legislative requirements and recommendations regarding animal experimentation. These legal requirements, along with the ethical implications of the research must be fully considered *before* any experimental work is undertaken.

The British Society of Animal Science has formulated the following set of ethical guidelines for animal experimentation which should be used alongside legislation that applies in the country of study and institutional ethical review procedures.

These guidelines are based around the principle of assessing the cost of experiments in the form of ‘harms’ to the animals involved and the potential benefits that might be realised from the research. They discuss ways of reducing costs (harms) to experimental animals but also of how to maximise the benefits of animal science research if it is undertaken.

2. Justification of research – Cost/Benefit analysis

Research has the potential to generate conflict between the researcher achieving objectives and the wellbeing of the animals involved. The justification for undertaking the research must be based on a systematic assessment before starting.

Any animal science research undertaken should have realistic and achievable aims of increasing our knowledge of the species of interest in relation to our understanding of its functioning, performance, health or welfare. These outcomes can be regarded as examples of ‘benefits’ of the research. However animals may suffer as a result of the experimental procedure itself and also as a consequence of sub-optimal housing or husbandry conditions. The ‘cost’ to animals can be defined as any harm in the form of pain, distress or other forms of suffering that an animal experiences at any stage of its life as a consequence of the research. The researcher must fully consider the likelihood of causing harm to the animals involved and decide whether the benefits are sufficient to justify the suffering. Formalisation of this cost/benefit analysis of research programmes can be conducted (see Mellor and Reid, 1994). By considering the costs to the experimental animals as well as the likely benefits of research, the researcher, if requested to, should be able to justify his/her use of experimental animals both to peers and in the public arena.

3. Ethical Review and Legislation

Before commencing a programme of research involving the use of animals, a researcher should:

- Be up to date with relevant literature in that area to avoid needless duplication of experimental work and the potential suffering of experimental animals.
- Discuss the potential use of the experimental animals with peers as this may identify areas of ethical concern that the researcher has not considered.
- Consider all available options to replace use of animals with other techniques that will allow the scientific objectives to be met
- Be able to justify the use of animals based on a cost/benefit analysis as discussed in section 2.
- Have obtained relevant authorisation at both local, and where applicable national levels as appropriate in the country of study. Even where experimental procedures are unlikely to cause pain, distress or other forms of suffering, and for example do not require national approval, it is recommended that local authorisation (from the organisation the researcher is representing and the place where the animals will be used) is gained before the commencement of the experiment.
- Consider and comply with local, national and international legislation relating to the acquisition, transport, housing and husbandry of animals (e.g. on the farm, or in the laboratory). This legislation will cover, for example, maximum journey times, minimum space requirements and group sizes, weaning ages and euthanasia techniques. Researchers should consider this legislation as being the standards that are used in applied situations and bear in mind that these are only minimum standards and can be improved upon. If any legislation relating to the keeping of animals will be contravened as a part of the experimental study then relevant national and local authorisation must be gained *before* the commencement of the study.
- Be up to date with scientific literature and guidelines relating to the keeping of animals, and incorporate this within their study to ensure the use of appropriate species-specific housing and management practices as recommended at the time of study.
- Particularly when planning to work under commercial conditions, give consideration to factors that may be outside of the researcher's control and which may lead to situations in which there might be additional potential for animal suffering, as well as potential infringements of legislation. Discuss the ethical and experimental implications of the occurrence of these undesirable events.

Any researcher submitting a paper to the journal, a summary or award application to the society may be asked to justify their use of experimental animals and describe the ethical evaluation that the study has gone through.

4. Considerations of the 3Rs (Refinement, Reduction and Replacement)

4.1 Refinement

Refinement deals with improving the welfare and reducing any pain, suffering and distress that may be experienced by *each* individual experimental animal at any stage of its life.

- *Species*

The species chosen for the experimental study should be the one most suited to realising the aims of the study. Choosing a species that is inappropriate will invalidate the study and is therefore ethically and scientifically unacceptable. Avoid choosing a species based on their *apparent* poorer perception of pain. This assumption may be misguided. Sheep, for example, like other prey species have evolved to instinctively and adaptively show little response to pain even though they may be suffering. Also avoid using species based on their *apparent* reduced capacity to suffer or be distressed. For example, although birds and fish do not show behavioural expressions similar to mammals in distressing situations, it should not be assumed that they are not suffering. Behavioural studies have shown that these animals too can perceive aversive stimuli and will act in a way to avoid further exposure to such negative experiences. Detailed knowledge of the species to be used is therefore a prerequisite.

- *Housing and management*

Housing and management of animals must comply with legislation relating to the keeping of animals in the country of study. When studying animals in extensive systems, guidelines and legislation relating to the supervision of the health and welfare of the animals must be adhered to. The impact of housing and management on the experimental animals should be considered even if this is not part of the experimental manipulation involved. Researchers should not only consider the minimum standards set out in legislation but also should refer to more recent literature and consider improvements to the housing and management of their experimental animals.

The natural behaviour and social structure of the study species should be considered and if possible be provided for in the experimental housing. For example, factors that should be considered are space allowance, group size and structure, frequency of cleaning and the quality and complexity of the environment. Environmental enrichment is encouraged. Unsuitable housing environments may cause behavioural and physiological aberrations in animals, and may impact upon the potential validity and applicability of any experimental results.

- *Personnel*

It is imperative that people working with experimental animals are fully trained in animal care, the experimental procedures to be used and understand the needs of the species they are caring for. This includes the ability to observe and assess when an animal may be in pain or distress, and the knowledge to then implement relevant measures to alleviate this suffering as quickly and as far as is possible. They should be fully aware of the legislation relevant to the keeping of animals and the use of animals in experimentation that applies to the study. The researcher should ensure that all personnel are responsible, confident in their ability and have the relevant experience to take on their specific duties within the study.

- *Routine practices*

Certain standard practices are undertaken, especially on farms and in laboratories, which may have the potential to cause a degree of animal suffering. For example, identification of animals, mutilations such as tail docking, teeth-clipping and beak-trimming, early weaning and castration. The researcher should consider whether these practices are a necessary part of the research and thus whether these practices could be omitted from the study. If for example identification of individual animals is required then the least invasive method possible should be chosen. Non-invasive methods (e.g. pen marking) should be considered particularly if the duration of the study is short. Invasive methods such as ear-tags and wing-tags may be used, however identification by mutilation such as ear notching and toe amputation requires special justification. If any mutilation or other routine invasive practice is carried out as part of an experiment then appropriate sedatives, anaesthetics and analgesics should be considered.

- *Experimental procedures*

- i) Infection

While the ultimate aim is most likely the prevention or curing of disease, animal health research often requires studies of infected animals. If possible, researchers should consider working with naturally occurring diseased animals and try to alleviate disease as opposed to inducing the disease in otherwise healthy animals. If deliberate infection of animals is required for the purposes of the research project then the duration and intensity of the diseased period should be minimised with appropriate procedures in place to intervene at pre-determined humane end-points.

- ii) Nutritional restriction

Restricting nutrition below maintenance requirements in growing animals should be avoided where possible. If exceptions are justified in specific cases, the severity and duration of restriction should be minimised. In reproductive animals, loss of bodyweight and condition can occur during periods such as lactation. Such reproductive animals should not be allowed to lose significantly more bodyweight or condition than would normally be expected. Where protein and energy restriction is required bulky diets should be used where possible so as to alleviate some of the suffering due to hunger.

- iii) Selective breeding and genetic modification

Experiments that involve selective breeding or direct genetic modification that are likely to affect the animal's integrity or lead to pain, suffering or an increased mortality rate require special justification in terms of benefit to the wider animal and human population.

iv) Physiological sampling

Researchers should consider the collection of physiological samples which are non-invasive (e.g. faeces, urine, saliva, hair). If invasive sampling is required any pain or suffering should be minimised. When repeated blood sampling is required the researcher should consider the implantation of indwelling catheters (using appropriate anaesthetics and analgesics). Researchers should ensure the total blood volume to be taken will not cause suffering and must consider the replacement of fluids. Appropriate anaesthetics and analgesics should be used where skin or other invasive tissue samples are required.

v) Deprivation

Resource (food, social contact, space and water) deprivation is used in animal science research and has the potential to cause animal suffering therefore the severity and duration of deprivation should be minimised. Food, in particular, may be withdrawn to motivate animals to perform certain tasks. In such studies, researchers should consider the possibility of giving positive food rewards (desirable foods) for performance of tasks thereby removing the need for food deprivation and a source of potential suffering.

vi) Aversive Stimuli

Some animal science studies employ the use of aversive stimuli (e.g. fear-inducing stimuli). Positive stimuli should always be considered as the primary method of choice as an alternative and consideration should also be given to whether a stimulus associated with a non-aversive cue can be used instead. Aversive stimuli should be avoided as far as is possible, but where it is used, the duration and severity of the stimuli should be reduced as much as possible

vii) Aggression

When studying aggressive behaviour the researcher must seriously consider the methodology to be used. If encounters between animals are occurring as part of farm practice then these encounters should be used where possible. If staged encounters are necessary strict guidelines relating to intervention should be developed and all personnel involved should be aware of these. The experiment should preferably be stopped at the first sign of aggression, but if the experimental protocol requires that the subordinate animal be subjected to the aggressor for a specified amount of time then adequate physical protection (e.g. cage) for the subordinate should be provided.

viii) Surgery

Where surgical procedures are undertaken appropriate levels of anaesthesia must be used. Researchers should ensure that the experimental animals are properly anaesthetised by a trained and responsible person. The surgical procedures should be carried out by a trained and competent person. Researchers should consider the use of general anaesthesia if there is any doubt over the efficacy of local anaesthesia. Pre- and post-operative close observation and care of experimental animals should always be employed; appropriate sedation, analgesic, antibiotic and anti-inflammatory treatments should be used.

ix) Previous experience of animals

The experiences animals have throughout their lives can affect the way they respond to challenges (which could impinge upon the applicability of experimental results). Therefore, where possible, all animals on an experiment should have a similar life history with respect to factors such as parental care, social and physical environment and nutrition. Wherever possible animals should be trained in advance to reduce the fear associated with procedures (e.g. regular considerate handling and familiarity with experimental situations).

x) Humane end-points

End-points for all experimental procedures should be determined before the commencement of the study and refined as appropriate as the study progresses. Death due to an experimental procedure is an unacceptable end-point. All personnel involved in carrying out the procedures should be fully aware of the humane end-points and be confident in carrying them out. Researchers should reassure more junior personnel that their informed judgement and decisions will be respected.

xi) Disposal of animals

Experimental animals can sometimes be re-used for other experimental work, however it should be ensured that any individual animal does not experience repeated stressful or painful procedures. Legislation relating to re-use of experimental animals must be adhered to. Experimental farm animals can often be returned to farm stock, however the

effect of the experimental procedures and the change of environment (physical and social) on the welfare of the animal should be considered fully.

If an animal has to be euthanased it is vital that this is done using the most humane method and it is recommended that a veterinarian be consulted. Experimental animals will sometimes be disposed of by standard practice (e.g. at a slaughterhouse) and so the researcher should consider the implications of this for the experimental animal. The animal should be confirmed dead before being discarded. For further details on methods of euthanasia see AVMA (2001) or Animals (Scientific Procedures) Act 1986 Guidance on Schedule 1 methods of killing.

4.2 Reduction

Reduction relates to the scientific, moral and legal requirement to expose as few animals to pain, suffering and distress as possible. Researchers should calculate how few animals are required to ensure they are able to obtain meaningful results. Where statistical significant differences are sought, power analysis can be used whereby known estimates/measures of:

- 1) the level of variability in the variable being measured
- 2) the level of difference expected between the treatments
- 3) the desired power of the overall comparison,

are used to define the sample size required

In some circumstances where the level of variability is unknown, or the expected difference between treatments is uncertain, estimates based on similar data sets within published literature can be utilised. Power calculations are also important to ensure that sample sizes in experiments are not too small to give statistically significant results, as this also represents wastage of animals and potential unnecessary suffering. A statistician with expertise in experimental design should always be consulted before carrying out any experimental work.

To ensure that researchers have complied with the requirement to consider reduction, the Editors of Animal and other referees may require justification and details of sample size estimates and power analyses where they have particular concerns.

4.3 Replacement

Replacement call for a researcher, where possible, to replace or avoid the use of living animals altogether with some other means of reaching the same experimental objective. In every instance, non-animal methods of investigation should be sought. Using living animals should not be the default action.

The types of substitution that can achieve replacement are diverse and include, for example:

- Statistical modelling on the basis of previously recorded data
- The use of previously recorded video-tapes in the case of an ethological/behavioural study
- *In vitro* techniques

5. Other considerations

In addition to the 3 R's (Refinement, Reduction and Replacement) there are some other considerations to be made when using experimental animals:

Source and transport of animals

It should be ensured that experimental animals are acquired from a reputable source following all legal requirements and, where relevant, international transport guidelines. Adequate transport facilities and personnel should be provided to transport experimental animals to and from the place of study with minimum distress.

6. Increasing the benefits

It is important to have realistic and achievable experimental aims. This can be facilitated by ensuring that the number and species of animals, experimental design and statistical tests are appropriate to test the hypothesis. This is aided, as mentioned above, by being aware of previous research to avoid duplication and any methodology that has been unsuccessful. Irrespective of the outcome of the study, the researcher has an ethical obligation to communicate the results accurately. For example, if the methodology the researcher used is unsuccessful then it is important that other

researchers in the field are informed to avoid using the methodology at the cost of the potential suffering of more experimental animals.

It is important to consider the significance of the aims of the study. Applied studies usually have a directly applicable aim, however more fundamental studies can also provide beneficial information which can subsequently assist more applied studies.

7. Contact and sources of information

Potential authors should consult the Editor in Chief if they have any queries relating to the ethical suitability of their research.

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The views expressed in this document are those of the authors, and are not necessarily representative of their affiliated organisations. The Royal Society for the Prevention of Cruelty to Animals is opposed to all experiments or procedures that cause pain, suffering, or distress, and works to promote initiatives that lead to greater applications of the Three Rs –replacing animals with humane alternatives, reducing the number of animals used, and refining husbandry and procedures to reduce suffering and improve animal welfare

9. Useful References

Web Resources

American Psychological Association (APA) "Guidelines for Ethical Conduct in the Care and Use of Animals". (<http://www.apa.org/science/anguide.html>)

Association for the Study of Animal Behaviour (ASAB) "Guidelines for the treatment of animals in behavioural research and teaching". *Animal Behaviour* **61**: 271-275. (<http://www.elsevier.com/inca/publications/misc/622782guide.pdf>)

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Other references

The 'British Veterinary Association (Animal Welfare Foundation) / Fund for the Replacement of Animals in Medical Experiments/ Royal Society for the Prevention of Cruelty to Animals / Universities Federation for Animals Welfare' - **Joint Working Group on Refinement** has also published the following guidance papers:

- Removal of blood from laboratory mammals and birds -*Laboratory Animals* (1993) 27, 1-22
- Refinements in rabbit husbandry -*Laboratory Animals* (1993) 27, 301-329
- Refinements in mouse husbandry -*Laboratory Animals* (1998) 32, 233-259
- Refining procedures for the administration of substances -*Laboratory Animals* (2001) 35, 1-42
- Refinements in husbandry and procedures for laboratory birds -*Laboratory Animals* (2001) 35 Supplement 1, 1-163
- Reduction and refinement in the generation, management and care of genetically modified mice -*Laboratory Animals* (2003) 37
- Refinements in telemetry procedures -*Laboratory Animals* (in press)
- Husbandry refinements for rats, mice, dogs and non-human primates used in telemetry procedures -*Laboratory Animals* (in press)