Rules of good practice in the care of laboratory animals used in biomedical research

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Summary. - In recent years, the use of laboratory animals has decreased as a result of the adoption of alternative methods such as in vitro experiments and simulation studies. Nonetheless, animal models continue to be necessary in many fields of biomedical research, giving rise to ethical issues regarding the treatment of these animals. In the present work, a general overview of the rules of good practice in caring for laboratory animals is provided, focussing on housing conditions and the proper means of handling animals, including the importance of the relationship or “bond” between the researcher and the animal.

Parole chiave: animal welfare, housing, handling, experimental procedures.

Introduction

Although the use of laboratory animals has in recent years been reduced through the adoption of in vitro experiments and simulation studies, it continues to be inevitable in many areas of biomedical research. Consequently, the treatment of these animals needs to be addressed, not only because of the important ethical implications but also in light of the fact that, when animals suffer, their physiological and behavioural responses can be altered, affecting the experimental results, the attainment of which is one of the major justifications for performing animal experimentation in the first place. In Europe, the care and wellbeing of animals used in biomedical experimentation is governed by Directive 86/609/CEE, which has been incorporated into the national legislation of individual countries, including Italy. As a supplement to this legislation, and in the attempt to improve the minimum standards of care, a number of scientific societies have developed their own guidelines.

In any case, the responsibility of ensuring animal welfare ultimately lies with the researcher, who to the greatest extent possible must ensure that the animal not to be subjected to suffering, pain, or distress, which can occur even when experimental studies are non-invasive, given that some form of handling is necessary for obtaining results. In the present work, a general overview of the rules of good practice in caring for laboratory animals is provided, focussing on housing conditions and the proper means of handling animals, including the importance of the relationship or “bond” between the researcher and the animal.

Housing

Unfortunately, in many cases housing conditions are designed primarily for the convenience of researchers and can in themselves cause a certain degree of suffering. In this section, some examples of suitable conditions for animals in captivity are provided.
In general, those features of the natural habitat that are important to the animal’s welfare should be reproduced to the greatest possible extent. Depending on the specific species, examples of these features can include natural materials, shelters, perches, and dust and water baths. Social animals must be provided with companions, although any potential suffering or injury caused by the presence of other animals should be avoided.

In various countries, including Italy, the legislation on animal care includes specific guidelines on housing conditions and husbandry practices. In general, in addition to the provision of high quality food and water, any limitations on the animal’s physiological and behavioural needs must be reduced. To this end, the cages in which the animals are housed should be large enough so that the animals can move around freely and easily reach their food and water. The recommended minimum dimensions depend not only on the specific species but also on whether or not the animal is in a reproductive phase (e.g., the cage must be large enough to house a mother and her offspring). In the guidelines included in Italy’s legislation, the minimum recommend surface area of a cage for a mouse is 180 cm² (200 cm² for mice of reproductive age or a mother and her offspring); the minimum height is 12 cm. For a rat, the recommended minimum area is 350 cm² (800 cm² for rats of reproductive age), with a minimum height of 14 cm. Moreover, animal species for which sociality is a basic feature, such as non-human primates, must be housed in groups or families, and incompatible species obviously cannot be housed in the same room.

With regard to the environmental conditions, ambient temperature must be within the recommended normal range for the specific species (e.g., 20-24 °C for rats and mice), taking into account that higher temperatures are often required for newborns and young animals. The relative humidity in the husbandry rooms has to be kept at 55% + 10%. Both temperature and humidity must be controlled on a daily basis. The ventilation system must maintain an adequate rate of flowing air cycles in husbandry rooms, with the specific rate depending on the number of animals in the space, the specific species, and the room temperature and humidity. Both the intensity of illumination and the light/dark cycle must also be controlled. Moreover, rooms should be soundproof, so as to avoid any intense noise or high sound frequencies, especially in husbandry rooms, where noise can greatly interfere with the animal’s behaviour.

Another important aspect of housing is hygiene. All surfaces of the cage, including the floor, walls, and ceiling, must be thoroughly cleaned and thus be made of a smooth washable material. Although the cages must be clean enough to prevent disease, the frequency with which they are cleaned must take into account the amount of stress induced by frequent handling and exposure to unfamiliar surroundings, odours, and bedding. Adequate hygienic standards must also be observed in storing food and in cleaning mangers, water containers, and any other devices used to feed the animals, and all materials, including food, should be kept in a clean dry place, away from any potential sources of contamination. Moreover, no dirty materials should be left where there are animals (e.g., dirty bedsteads should be taken immediately to the incinerator and dirty cages to where they are to be washed). When entering the husbandry room, overshoes, overalls, disposable gloves, and a face mask should be worn.

Animal handling and experimental procedures

An important part of the routine care of animals and animal experimentations is the relationship between the animal and the researcher or other staff that have contact with the animal. When interacting with an animal, the individual should be quiet and fearless, not only to properly perform the various operations necessary for the experiment but also because of the animal’s ability to perceive the handler’s attitude and mood. The degree of perception obviously depends on the specific animal species. For example, rats are much more sensitive than mice and are more capable of recognising the handler, and any change can cause anxiety or other forms of stress. Rats are also very sensitive to noise and sudden movements on the part of the handler. For instance, any rough, quick, or unexpected hand movement can upset the rat, so that it assumes a more cautious and sometimes more aggressive attitude. To facilitate the animals’ getting used to handlers, thus minimising stress, the personnel can be trained in the use of specific techniques. Stress can also be reduced by training animals to cooperate with handlers during routine husbandry and experimental procedures. For behavioural studies, tests should always be conducted at the same time of day and the researcher should not change his/her behaviour in any way. He/she should avoid making gratuitous noises, the use of perfumes (especially if conducting a homing test of an olfactory nature), changing the animals’ diet (especially if conducting food-preference tests), or modifying the position of objects in the chamber in which locomotory-orientation tests will be done.

Another source of stress for animals is the smell of the blood or urine of a previously tested animal, which can induce physiological reactions such as the production of stress hormones, thus altering the animal’s responses. For this reason, when conducting experiments that entail, for instance, performing injections or dissection, the animals should not be subject to the experiment in the presence of other animals and they should not be placed in an experimental chamber in which the smell of another animal is still detectable.
Generally, the experimental chamber (e.g., the cage or labyrinth and other equipment) should be thoroughly cleaned with scentless substances before testing an animal.

**Recommended reading**

This work represents an attempt to summarise some basic principles in ensuring the welfare of animals used for biomedical research. For a more in-depth exploration of this and related issues, the author suggests consulting the following, though partial, reading list, in addition to the other works published in the present volume.


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