GUIDELINES ON THE CARE OF LABORATORY ANIMALS AND THEIR USE FOR SCIENTIFIC PURPOSES

I – HOUSING AND CARE

The Royal Society

UFAW

THE UNIVERSITIES FEDERATION FOR ANIMAL WELFARE

GUIDELINES ON THE CARE OF LABORATORY ANIMALS AND THEIR USE FOR SCIENTIFIC PURPOSES

I. HOUSING AND CARE

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1. PREFACE

Arising from a proposal by the Laboratory Animals Science Association, the Councils of the Royal Society and the Universities Federation for Animal Welfare (UFAW) set up a Steering Group that invited groups of specialists to prepare guidelines, setting out basic principles for the conduct of animal experiments and for the care of stock, to be used by all persons responsible for laboratory animals and particularly by licensees and others now working under the authority of the *Animals (Scientific Procedures) Act, 1986.*

Several sections of the guidelines have yet to be finalised, but the Councils are now issuing those relating to housing and care of laboratory animals.

These guidelines are a consensus of views obtained from scientists and consultants working in academic and industrial spheres as well as from societies and associations that have a direct interest. They take into account informed public opinion, the advice of the Animals (Scientific Procedures) Inspectorate, and views of the statutory Animal Procedures Committee. Due regard has also been taken of the *European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes* (Council of Europe, 1986).

Under the 1986 Act the Secretary of State is to issue codes of practice as to the care of protected animals and their use for regulated procedures and may approve such codes issued by other persons. It is understood that these guidelines may be considered by the Home Office for possible adoption, after the necessary wide consultation, as a code of practice.

The guidelines on accommodation and care in Appendix A of the European Convention are not mandatory. They were regarded by the Council of Europe as 'recommendations to be used with discretion, designed as guidance to the practices and standards which all concerned should conscientiously strive to achieve'.

The following guidelines should be applied on a similar basis; they are not a code of practice. Throughout these guidelines the term 'must' is used only where the reader is being reminded of legal or otherwise commonly accepted obligations. The term 'should' is generally adopted and used to encourage attainment of desirable standards.

The 1986 Act provides the framework for the protection of vertebrate animals used for regulated scientific procedures. Primary responsibility for the proper treatment of the animals remains with those who handle them. It is the hope and intention of the Royal Society and the Universities Federation for Animal Welfare that these guidelines will assist such persons in meeting their obligation and thereby advance the welfare of such animals. Good science and animal welfare should continue to go hand in hand.

2. HOUSING AND ENVIRONMENT

Introduction

These guidelines are intended to help those responsible for the care of laboratory animals and for designing and constructing animal facilities.

In scientific work involving live animals the most reliable results are likely to be obtained by using healthy animals that are well adapted to their housing conditions and, in quantitative assays or comparisons, precision is increased if those animals are uniform. The guidelines are based on current knowledge and practice and as knowledge develops they may need to be amended.

The European Convention (Council of Europe, 1986) provides that:

> "Any animal used or intended for use in a procedure shall be provided with accommodation, an environment, at least a minimum 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. In the implementation of this provision, regard should be paid to the guidelines for accommodation and care of animals set out in Appendix A to this Convention."

These principles have been borne in mind throughout the preparation of these guidelines.

All animals, except when undergoing regulated procedures licensed under the *Animals (Scientific Procedures) Act, 1986*, are subject to other controls, for example: the *Protection of Animals Act, 1911 (1912 Scotland)*, regarding causing or permitting any unnecessary suffering. The *Agriculture (Miscellaneous Provisions) Act, 1968*, relates to farm animals and attention is drawn to the various Codes of Recommendations for the Welfare of Livestock issued under this Act by the Ministry of Agriculture, Fisheries and Food (MAFF Codes). The *Animal Health Act, 1981*, and *Diseases of Animals (Northern Ireland) Order, 1981*, apply in respect of notifiable diseases and the *Wildlife and Countryside Act, 1981*, and *Wildlife (Northern Ireland) Order, 1985*, relate to the taking of wild animals. This list is not exhaustive and if in doubt advice should be obtained from the Home Office Inspectorate. Other provisions may apply in Northern Ireland. Licensees should note that in Northern Ireland the 1986 Act is administered by the Department of Health and Social Services under the control and direction of the Secretary of State for Northern Ireland.

Where animal facilities do not conform to the standards recommended here it is hoped that modifications necessary for the well-being of the animals will be made without delay. New facilities should as far as possible meet the standards, but nothing in these guidelines is intended to imply that absolute uniformity is in itself desirable, or as making a case for change to achieve uniformity for its own sake. Home Office Inspectors will have to consider whether the facilities, or any proposed building works, are acceptable as part of their enquiries before making a recommendation to the Secretary of State on applications for licences and certificates of designation. When substantial alterations to the premises are proposed it will be advantageous to consult the Inspector at an early stage.

Those responsible for laboratory animals should have a thorough training in their care and be familiar with the basic requirements of their animals under normal and experimental conditions. Users need to be aware of the legal and moral

responsibilities of using animals in scientific procedures and realise the importance of and be competent in correct animal handling and restraint. They should also be competent in the procedures they will be carrying out (Smith, 1984).

Under the *Health and Safety at Work etc. Act, 1974*, the person in charge of a unit is required to ensure that it is a safe and healthy place in which to work. Staff should be aware of the action to be taken in case of accident, fire or other emergencies. Occupational asthma caused by exposure to laboratory animals is a prescribed disease (Industrial Injuries Advisory Council, 1986). For further information, see Seamer and Wood (1981), Smith (1987), Advisory Committee on Dangerous Pathogens (1984), Institute of Biology (1985) and Association of the British Pharmaceutical Industry (ABPI) (1987).

The animal house

General

An animal house should be designed, sited and constructed to provide a suitable environment, including any special requirement for exercise or social contact for the species to be housed and should incorporate facilities sufficient for the activities carried out within it. When siting an animal house, consideration should be given to the activities in the adjacent buildings and any effect these may have on the welfare of the animals. An animal facility forming a part of a larger complex should be designed to be self-contained and to prevent access by unauthorised persons. Wild, stray or pet animals should not be able to gain entry to any part of the animal house, including stores and personnel areas. Special care should be taken where drains and other services pierce the walls or floors.

Security

The animal house and its facilities should be designed to prevent animals escaping. It has also proved necessary to protect animal facilities against illegal entry. Advice should be taken from Crime Prevention Officers in the local police force or other experts in the field during the design of new facilities or modifications of existing premises.

The animal rooms

For the purpose of these guidelines, an animal room means the room normally used to house laboratory animals, for breeding, as stock or for procedures other than surgical. In general, major surgery and euthanasia should not be performed in rooms where animals are normally housed or where other conscious animals are undergoing procedures. Surgery from which animals are to recover will normally be carried out under aseptic conditions in a designated operating room. Minor procedures may be carried out in a designated area within the animal room or in a separate room designed for this purpose. Animals inoculated with infective agents transmissible to other animals held on the premises should be contained within a designated area.

Animal rooms should be constructed of impervious materials, with easily cleanable surfaces that are resistant to attack from the chemicals used to clean or fumigate the rooms. Consideration should be given to using materials that are least likely to crack and craze. Floor finishes should be non-slip whether wet or dry. All joints between door frames and walls etc., should be sealed. Floor to wall, wall to ceiling and wall to wall junctions should be coved for easy cleaning. Animal rooms should be protected

against ingress by pests such as wild rodents and insects; special care should be taken where drains are present (see Rentokil Guide – Keeping pests out of business premises). Services should be installed in such a way that they are either buried within the fabric of the building, boxed in or clear of the wall surface for easy cleaning. When the fabric of the building is penetrated the holes created should be sealed. Design should take into account the fact that building maintenance may disturb animals and disrupt experiments. Services should be installed to be accessible from outside and with fittings that can be removed by the staff for maintenance or repair elsewhere.

Farm animals in pens generally require more robust wall and floor finishes and there should be no projections that may present a hazard to animals or staff. Farm animals that are kept in animal houses should be given at least as much room as recommended in the MAFF Codes. For some procedures the standards of environment and housing required may be much higher than where animals are kept under farm conditions. Exercise areas should be provided for larger farm animals but in some cases such facilities may be impracticable from an experimental, environmental, disease control or security point of view.

Maximum stocking levels are limited primarily by the efficiency of the ventilation system. The stocking density for each room for each species likely to be housed should be calculated and be readily available (see *Ventilation*, page 7). Any smell of ammonia is probably because the room contains too many animals, or there is too little ventilation or the room is not being cleaned adequately, or a combination of all these factors; the cause should be investigated.

Species that are incompatible, for example predator and prey, or animals requiring different environmental conditions or of different health status, should not be housed in the same room nor, in some cases, within smell or even within earshot.

Precautions should be taken in animal rooms to minimise the exposure of personnel to hazards arising from handling animals, for example bites and scratches, allergens and infections (UFAW, 1987).

There should be provision to house separately animals that are ill or injured.

Breeding animals are normally maintained separately from animals in procedures. According to the microbiological and genetic quality of animal desired, different levels of separation and physical barrier will be required between breeding and other areas. Breeding and supply facilities will need areas to prepare animals for despatch.

Adequate arrangements should be provided for the receipt of incoming animals. Animals brought into an animal house should not put at risk animals already there. Space should be provided for isolation and acclimatisation, where appropriate.

General and specialist procedure rooms should be provided as appropriate and may vary from offering minimum facilities, to negative pressure isolators or laminar flow cabinets for studies with infectious agents.

Service areas and support facilities

The design and construction of service and circulation areas should normally be of the same standard as the experimentation areas. The building should be planned to prevent cross-contamination between clean and dirty equipment. Corridors should be wide enough for easy movement of personnel and equipment. Service areas are subject to much rough treatment and wall surfaces should be resistant to impact damage, with guard rails to protect walls and corners. Surfaces and corners should be easy to clean. Adequate floor drainage should be provided in wash areas with sufficient ventilation to remove excess heat and humidity.

There should be adequate storage space; corridors should not be used for storage.

Separate stores should be provided for food, bedding, cages, cleaning materials and other items. Food and bedding stores should be clean and dry; food stores should be vermin proof, insect proof, cool and sunless. Perishable foods should be stored in cold rooms, refrigerators or freezers.

A collection area, vermin free, should be provided for waste, prior to its disposal. Special arrangements should be made for handling carcasses and radioactive or other hazardous material.

All establishments should have access to separate facilities for diagnostic investigations, post-mortem examinations and the collection of samples for examination elsewhere. These rooms may not necessarily be in the animal house.

Where surgery is to be performed, suitable operating facilities should be provided, including separate preparation areas for the animals, equipment and staff and there should be a post-operative recovery area.

Personnel facilities

Personnel facilities should include staff and record rooms, and sufficient changing rooms, decontamination areas, first aid and toilet facilities, and space for storing protective, and outdoor clothing, etc. Smoking, eating and drinking should be prohibited from all but specifically designated areas.

Animal care personnel may be present at times when normal catering facilities may not be available; special arrangements or facilities for meals may therefore be needed.

Training and staffing

The person named in the certificate of designation of the premises as responsible for the overall welfare of the animals should ensure that adequate training is provided for other personnel. The degree of training required will depend on the activities being carried out. Only competent staff should be given responsibility for the care and husbandry of animals. Suitably qualified staff must be available at all times to care for the animals, not least during weekends, statutory holidays and when the normal staff are absent, e.g. due to sickness.

Information on training and courses in laboratory animal science and technology is available from the Business and Technician Education Council, the Institute of Animal Technology, the Royal College of Veterinary Surgeons and the Royal Veterinary College, University of London. Several pharmaceutical companies arrange courses for their own staff (see also Smith, 1984).

Veterinary care

Under the 1986 Act it is a requirement for registration as a designated premises that there is a named veterinary surgeon (or other suitably qualified person) to provide advice on the health and welfare of the animals. It is important that the veterinary surgeon has knowledge of the needs of laboratory animals.

The environment

Ventilation and humidity control are important for the welfare of animals; temperature should be controlled to ensure that animals do not suffer from either heat or cold stress. Experimental results may be influenced by environmental conditions (Clough, 1982) and animals should be kept under conditions that favour a consistency of response to scientific procedures. A close control of room temperature is desirable

for procedures in which the reaction of the animal to, for example, a toxic test substance, is highly temperature-dependent. Variations are not so critical for procedures in which results are qualitative rather than quantitative and where adequate control groups are used. For breeding, a daily fluctuation in temperature may be positively beneficial.

Temperature

Animal room temperatures should be continuously monitored and checked at least once daily. Table 2.1 gives the recommended limits within which room temperatures should generally be maintained when the outside temperature is between −2°C and +27°C. (Chartered Institution of Building Services Engineers (CIBSE), 1986–87).

Temperatures within the cages will be higher than room temperature. Even in rat cages with grid floors in a room with efficient ventilation, the temperature will be 3–6° above room temperature, according to the position of the cage in the room (Clough, 1984). If bedding material is present, the animal can manipulate its own immediate environment and provide a warm nest for its young. If an animal's thermoregulatory ability has been affected by anaesthesia or other scientific procedures, a higher room temperature or more bedding material should be provided (Clough, 1982).

Table 2.1 GUIDELINES FOR ROOM TEMPERATURE FOR STOCK ANIMALS AND DURING SCIENTIFIC PROCEDURES

Adults	*Optimal range in °C*
Non-human New World primates	20–28
Non-human Old World primates	15–24
Mouse	19–23
Rat	19–23
Syrian hamster	19–23
Gerbil	19–23
Guinea-pig	16–23
Rabbit	16–20
Small birds	19–23
Quail	16–23
Pigeon	15–24
Domestic fowl and duck	12–24
Cat	15–24
Dog	15–24
Ferret	15–24
Pig	15–24
Goat	10–24
Sheep	10–24
Cattle	10–24
Horse	10–24

The target in user establishments should be to maintain the room temperature in a band width of 4°C, the whole of the band lying within the optimal range indicated.

Temperature regulation should ensure that there are no undue fluctuations within or between rooms and so avoid causing unnecessary stress. In the majority of establishments in the United Kingdom it will be desirable to provide a cooling system for rooms containing rodents and rabbits to comply with the upper limitations for room temperatures. If this is not available *ad hoc* methods, such as reduction of stocking densities, may be necessary to avoid heat stress.

Breeding colonies do not usually require such close control of temperature. A tolerance of at least ±5°C may be sufficient so long as the newborn can be kept warm.

Animals kept outdoors or under farm conditions indoors will be maintained at ambient temperatures; for some species shade or shelter will be required in the summer, and in winter, additional heat and food as well as shelter.

Requirements for birds vary according to species (see MAFF Codes and UFAW, 1987).

Reptiles and amphibians are unable to control their body temperature except by behaviour. Each species has a preferred body temperature and a range in which it will feed and behave normally. The aim in the laboratory should be to provide such a range (UFAW, 1987). Where amphibians are maintained at low temperatures, they and their environment should be checked daily.

Fish should be kept as close to their natural environmental temperature as practicable (Hawkins, 1981).

Relative humidity

Extreme variations in relative humidity can have adverse effects on the well-being of animals (Clough, 1984) and, by affecting the rate of heat loss, can influence activity and food intake (Stille, Brezowsky & Weihe, 1968).

The relative humidity in animal rooms should normally be maintained at 55 ±10 per cent irrespective of stocking density; prolonged periods below 40 per cent or above 70 per cent should be avoided. In most cases some form of humidification will be required. Poultry are more tolerant than mammals and a range of 30–70 per cent is suitable (Prince *et al.*, 1965).

For most amphibians and some reptiles, 70 per cent is desirable but 'dry' reptiles should be kept at 40–60 per cent. Some other amphibians and reptiles may require humidity outside those ranges (Avery, 1979; Davies, 1981; Spellerberg, 1982).

Ventilation

The functions of the ventilation system are:

1. to regulate within prescribed limits temperature and humidity,
2. to reduce the levels and spread of odours, noxious gases, dust and infectious agents,
3. to provide sufficient air of an appropriate quality.

The ventilation rate of the room should be related to its stocking density and to the heat generated by equipment in the room (thermal load). In fully stocked rooms for rodents and lagomorphs, 15–20 changes of fresh or conditioned air per hour distributed throughout the room are normally adequate. For cats, dogs and primates 10–12 changes per hour may be adequate. Lower stocking densities may permit fewer air changes. The air distribution system should deliver as even a proportion of air to each cage or animal as possible whilst avoiding draughts (Clough, 1987). Careful consideration should be given to air inlet and outlet positions to avoid draughts and

noise disturbance. In general, environmental conditions for both staff and animal health may be improved by higher rates of air change and properly directed air flow.

The ventilation system can be used to create differential air pressures within the building as part of a 'barrier' system. 'Clean' areas are generally maintained at higher and 'hazardous' areas at lower air pressures than those adjacent to them to minimise the leakage of 'dirty' air into 'cleaner' areas, and hence the escape of airborne hazards into the air outside the premises. These effects are possible only if the supply air is itself free or is suitably filtered to be free from contaminants.

For further information on farm animal housing see MAFF Codes, British Veterinary Association (1984), Carpenter (1972) and CIBSE (1986–87). For further information on laboratory animals see Clough (1984 and 1987) and McSheehy (1976).

Lighting

Most laboratory mammals are either crepuscular or nocturnal. Their eyes are adapted, therefore, to dim light conditions and few of them (other than primates and perhaps cats) have any colour vision. Light-induced retinal damage occurs principally in albino animals most severely when recovery periods in darkness are too short (Weisse, Stotzer & Seitz, 1974; Stotzer *et al.*, 1970; Greenman *et al.*, 1982; Bellhorn, 1980; Weihe, 1976). The three important aspects of light are its intensity, wavelength and photoperiod.

Intensity – 350–400 lux at bench level is adequate for routine experimental and laboratory activities. Measures may be required to avoid undesirably high levels inside cages (Clough, 1984; Porter, Lane-Petter & Horne, 1969).

Wavelength – Few laboratory animals other than primates have colour vision although there is some evidence that wavelength can nevertheless have an effect (Spalding, Archuleta & Holland, 1969; Spalding, Holland & Tietjen, 1969; Salterelli & Coppola, 1979). There is no evidence to indicate that either flourescent or incandescent lights have any adverse affects.

Photoperiod – The importance of light:dark (L:D) cycles in regulating circadian rhythms and stimulating and synchronising breeding cycles is well documented (Clough, 1982). For the majority of laboratory animals a daily cycle of 12:12 hours is suitable. The circadian 'clock' of some species may be affected as much by light pulses of less than one second during the dark phase as by a long photoperiod; thus it may be important not to turn on lights during the dark period (Clough, 1982; Ellis & Follett, 1983). On the other hand, intervals of darkness during the light period are not known to be disruptive.

Dawn and dusk – For some species of primates, birds and fish a simulated dawn and dusk may be required. This can be provided by the use of either automated dimmer switches or low wattage bulbs that remain on into, or during, the period of darkness (Stoskopf, 1983).

Windows

There are advantages and disadvantages in having windows in animal rooms. Windows allow fluctuations in light intensity during daylight and in photoperiod throughout the year. They interfere with temperature control, particularly if they admit direct sunlight and are a weak point in the security of the building. On the other hand, natural lighting has a beneficial effect on the well-being of staff (Clough, 1987).

Noise

The significance of noise and its importance in relation to laboratory animals are reported in Gamble (1982) and Clough (1982). Loud, unexpected and unfamiliar sounds are probably more disruptive than constant sounds. There is no indication that constant background noise, such as that generated by air-conditioning and similar equipment, is harmful to animals providing it is not too loud; the ability of such sounds to mask noise is, however, unproven (Fletcher, 1976; Pfaff & Stecker, 1976).

Because different species have the ability to hear sounds of different pitch (frequency) (Clough, 1982; Sales & Pye, 1974) and loudness (Clough, 1982; Pfaff, 1974), and because of variations in sounds that occur in animal houses, it is not possible to give firm recommendations for noise levels. However, it has been found empirically that if the general background sound level in an empty animal house can be kept below about 50dB(A), below a noise rating curve of 45 and is free from distinct tonal content, then it is unlikely that there will be damage to animals or personnel when the room is in use (CIBSE, 1986–87).

Excessive noise and vibration most commonly arise from imperfectly balanced rotating or reciprocating machinery which is usually sited in a plant room. Vibration is most often noticeable during machine start-up (i.e. low-frequency movement) when some machines have to pass through a critical (resonant) speed before reaching their normal operating condition. Such disturbances may not be important if the machine operates for long periods; machines that switch in and out, however (perhaps due to a thermostatic or other operational controller), may require special precautions. Vibrations transmitted by machines through their base to the building structure may be felt at considerable distances from the plant, in extreme cases even in neighbouring buildings (CIBSE, 1986–87).

Special environments

There have been several developments aimed at increasing the separation between animals and personnel to provide, *inter alia*, protection from dangerous pathogens (Advisory Committee on Dangerous Pathogens, 1984) and to contain other hazardous substances such as potential carcinogens and allergens. Devices used include filter caps and bonnets, environmental chambers, filter-racks, safety cabinets and isolator systems (Clough, 1987). All can be effective if used properly and each has its advantages and disadvantages. As their use can lead to a false sense of security expert advice should be sought before selection particularly with the more sophisticated and hence generally more expensive equipment.

Emergency alarms and stand-by systems

A modern, technologically dependent animal facility is a vulnerable entity. It is strongly recommended that such facilities are appropriately protected to detect hazards such as fires and the breakdown of essential equipment such as ventilation fans, air heaters, coolers, etc, and the intrusion of unauthorised persons. Care should be taken to ensure that where possible the operation of the alarm system causes the minimum of disturbance to the animals; an example of this is the use of the so-called 'silent' fire alarm which is inaudible to small rodents (Clough & Fasham, 1975).

In modern animal facilities that rely heavily on electrical or mechanical plant for environmental control and protection there is a need for stand-by equipment in order to maintain essential services and emergency lighting systems as well as to ensure that alarm systems themselves do not fail to operate. It should be borne in mind that certain species will not eat in the absence of light.

Monitoring devices should be installed in connection with the heating and ventilation system to enable the staff to be assured at all times that it is working satisfactorily and maintaining the correct environment.

3. ANIMAL CARE AND HEALTH

Introduction

Animals kept within an animal house are totally dependent on man for their health and well-being. Their physical and mental state will be influenced by their surroundings, food, water and the care and attention provided by the animal house staff. The aim is to maintain animals in good health and physical condition, behaving in a manner normal to the species and strain, amenable to handling and suitable for the scientific procedure for which they are intended. All animals should be inspected at least once daily and routine examinations should be carried out with sufficient frequency to ensure that their health and well-being is maintained. Those subject to scientific procedures must be inspected at a frequency commensurate with the severity of the interference.

Responsibility for the care of laboratory animals falls upon:

- individual users, whether licensees or not, who must assume ultimate responsibility for all their animals,
- the person specified as responsible for the day to day care of the animals,
- the named veterinary surgeon (or other suitably qualified person) who provides advice on the health and welfare of the animals,
- the animal technician.

Sources of animals

Under the 1986 Act the following commonly-used species that are bred for laboratory use: mouse, rat, guinea-pig, hamster, rabbit and primate must be obtained from designated breeding or supply establishments. Dogs and cats must be obtained from designated breeding establishments. The Secretary of State may issue exemptions. (*Note:* not all relevant sections of the Act have yet come into force.)

Cattle, sheep, pigs, horses, poultry and other birds, reptiles, amphibians and fish may be obtained from specialist breeders or other commercial sources.

Importation of animals from overseas is controlled by the *Animal Health Act, 1981*, and for some species by the *Endangered Species (Import and Export) Act, 1976*. Details about licences, health certificates, rabies and other quarantine requirements should be obtained from the Animal Health Division, MAFF, or the Department of Agriculture for Scotland (DAFS) and from the Wildlife and Conservation Licensing Section, Department of the Environment (DOE), Bristol. In Northern Ireland this is administered by the Department of Agriculture.

Many wild animals including birds, fish, reptiles and amphibians are protected by the *Wildlife and Countryside Act, 1981* (in Northern Ireland by the *Wildlife (Northern Ireland) Order, 1985*). There is additional statutory protection of badgers, seals and deer. The *Dangerous Wild Animals Act, 1976*, applies to the keeping of some animals. Further information may be obtained from DOE, Bristol. (The Act does not apply in Northern Ireland.)

Trapping methods (see Twigg, 1975; Schemnitz, 1980) must be humane and should be undertaken only by competent people. If chemical restraint is necessary, it should

be done under the supervision of a veterinary surgeon or other authorised person. The permission of MAFF may be required.

If in the capture of large animals it is necessary to use an anaesthetic or immobilising agent, this should be administered by a veterinary surgeon or other authorised person.

Tranquillising weapons including blowpipes are classed as prohibited weapons under the *Firearms Act, 1968*, and may only be acquired on the authority of the Home Office and with a permit from the local Chief Constable. The tranquillising agent will itself be subject to additional control under the *Misuse of Drugs Act, 1971* (Home Office, 1978; Porter, 1982).

Any animal that is injured should be given first aid and, if necessary, examined as soon as possible by a veterinary surgeon.

Transportation

Stress during transportation should be minimised by making animals as comfortable as possible in their containers and if confinement is to be prolonged, by providing food and water. Time in transit should be kept to a minimum (Clough & Townsend, 1987; Wallace, 1984). The sender should ensure that the animals to be transported are in good health and adequately labelled. Animals that are incompatible should not be transported together. Sick or injured animals should be transported only for purposes of treatment, diagnosis, or emergency slaughter. Pregnant animals need special care. Farm animals should not normally be transported during the last week of pregnancy and small animals in the last fifth of pregnancy. Farm animal transport is regulated by various orders now under the *Animal Health Act, 1981*, and details should be obtained from MAFF.

Where animals are subject to control under the 1986 Act it is necessary to consult the Inspector for authority to transfer them to other designated premises. Where laboratory animals are to be imported or exported advice should be sought from the local Divisional Veterinary Officer, MAFF and the Home Office.

The advice of the DOE should be sought about the transport of wild animals.

For the transport of fish see Hawkins (1981).

Reception

Animals should be removed from their transport containers with the least possible delay. After inspection, the animals should be transferred to clean cages or pens and be supplied with food and water as appropriate. Animals that are sick, injured or otherwise out of condition must be kept under close observation, housed separately and examined by a veterinary surgeon (or other competent person) as soon as possible.

A record should be made of animals received, their source and date of arrival. Animals should be identified by cage labelling in the case of rodents and other small laboratory animals. Dogs, cats, primates and farm animals, if not already identity-marked, should be allocated individual numbers, e.g. by tattooing or ear-tagging. If permanent marking is not practicable, e.g. in marmosets, the animal should be fitted with a collar or necklace bearing its number.

Acclimatisation and quarantine

Acclimatisation is necessary for an animal to overcome the stress imposed by transport and subsequent exposure to a new environment with different diet, microflora and a change of human contacts before subjecting it to scientific procedures. The period of

time required will vary according to circumstances and should be determined by the user in consultation with the animal house manager (Steinberg & Watson, 1960; Grant *et al.*, 1971; Steyn, 1975; Landi *et al.*, 1982).

All imported animals are subject to statutory control by licences issued by MAFF. A period of quarantine may be given as a condition of the licence and details of the requirements can be obtained from local veterinary officers. The *Rabies (Importation of Dogs, Cats and other Mammals) Order, 1974*, as amended gives the period of quarantine for some animals. Wild-caught animals should be housed separately from laboratory bred ones to prevent transmission of infection and an acclimatisation period of up to 3 months may be necessary if they are to be used for breeding.

Care of animals

Animal accommodation

Building and environmental control have been dealt with in Chapter 2. Size, shape and fittings of pens and cages should be designed to meet the physiological and behavioural needs of the animals. The shape of the cage and the furniture provided may be as important to the animal as the size of the cage. Social relationships are as important as stocking densities and room must be allowed for growth of the animals. Some animals continue to grow into old age although they become less active.

Guidance on cage and pen dimensions is given in Tables 3.1–3.11 in which height and area are the internal not the overall dimensions. The sizes suggested are broadly in line with the recommendations of Appendix A of the European Convention (Council of Europe, 1986). Where they differ it is to take account of good current British practice and the sizes are intended to be used with discretion and indicate standards that users should strive to achieve.

The pens or cages should be made of material that is not detrimental to the health of the animals and that is resistant to cleaning agents and techniques. They should be designed to minimise risk of injury with comfortable floors that permit easy removal of excreta. Animals should be housed so that they can be easily inspected.

Pens for larger animals should have stable, non-slip floors. If slatted floors are used, design and finish must allow the animals to lie comfortably without injury to legs, feet or udders. Cows housed on slatted floors should have a separate solid floored area with straw or bedding material (MAFF Codes).

Floors, walls and doors should have surface resistant to wear and tear caused by the animals or by cleaning procedures.

Farm animals may be kept for scientific procedures in paddocks, yards, etc., which have been designated for the purpose.

Post-operative recovery pens and cages may be smaller than the sizes suggested, and some procedures may require a more restrictive system of housing but this should be for a limited time only.

Bedding and nesting material

Bedding should be comfortable for the particular species, dry, absorbent, not dusty, non-toxic and free from infectious agents, vermin and other forms of contamination. Sawdust or shavings should not be derived from wood that has been treated chemically. Nesting materials should provide insulation but cause no hazard to the young or adult animals (UFAW, 1987). Where large animals are housed on concrete, cattle mats should be used to protect pressure points.

Food

Diet should be formulated to satisfy the nutritional requirements of the animals (Clarke *et al.*, 1977). In the selection, production and preparation of food, precautions should be taken to avoid chemical, physical and microbiological contamination. Food should, when appropriate, be packed in sealed bags that are stamped with the production date. Packing, transport and storage should avoid contamination, deterioration or destruction of the food. Perishable foods should be stored in cold rooms, refrigerators or freezers.

Diets for disease-free animals should be treated to destroy vegetative organisms, parasites, pests and spores. Diets for germ-free or gnotobiotic animals must be sterilised by autoclaving or irradiating (Coates, 1984).

All food hoppers and utensils should be cleaned regularly, and their sterilisation considered. If moist food is used or if the food is easily contaminated, daily cleaning is essential.

The method of feeding will vary according to the species. Where animals are held in groups, care should be taken to ensure that subordinate animals have adequate access to food and water. Consideration should be given to the avoidance of obesity by controlling food intake (Tucker, 1984; Eva, 1984).

For fish nutrition see Halver (1972).

Water

Potable water should normally be available to all animals at all times. It is usually provided in water bottles or other containers or by an automatic system. During transport it is acceptable in some cases to provide water in the form of a moist diet (Peters & Bywater, 1985).

Water is a vehicle of micro-organisms and the method of supply should minimise this hazard. When bottles are used, they should be sterilisable and transparent or translucent to enable their contents to be observed. They should be wide-mouthed for easy cleaning. If plastic material is used, it should be resistant to leaching and suitable for sterilisation. Caps, stoppers and pipes should also be sterilisable and easy to clean. All bottles and accessories should be dismantled, cleaned and sterilised at intervals. Bottles should be replaced by clean, full ones rather than being topped up in the animal rooms. Water containers should not tip or spill easily.

The operation of automatic systems should be checked daily; they should be properly serviced and cleaned regularly to avoid malfunction and the risk of spread of infections. The water system should be monitored for quality and purity to avoid bacterial contamination. If solid bottomed cages are used, precautions should be taken to avoid flooding. Emergency supplies should be available in case pipes freeze or supplies otherwise fail.

The successful keeping of fish in the laboratory depends upon maintaining water quality within the range that will allow survival and growth. Uneaten food debris and excretory products must be removed from the tanks, and the dissolved oxygen concentration should be maintained at least at 5mg/l. When preparing water for salt water aquaria, the specifications are critical (Stephan, 1975; APHA-AWWA-WPCF, 1975; Adema, 1980; Hawkins, 1981).

The tolerance of fish, amphibians and reptiles to changes in pH, chlorine and other chemicals differs widely from species to species and water quality in aquaria and tanks must take account of these differing needs and tolerance limits.

Exercise and handling

All animals must be allowed to exercise. For the smaller species, this is usually achieved by providing adequate cage sizes. For larger species (dogs and primates in particular), special arrangements will usually be required for social contact as well as exercise. Exercise in passageways may be acceptable provided adequate space and time are made available and it does not disturb other animals.

The behaviour of an animal during a procedure depends very much on its confidence in its handler, which can be developed through regular human contact. This confidence, once established, should be preserved. Where appropriate, time should be set aside for handling and grooming. All staff, both technical and scientific, should be sympathetic, gentle and firm when dealing with the animals.

Cleaning

Regular cleaning and maintenance and a high standard of hygiene are essential for good husbandry. Routines should be established for cleaning, washing, decontaminating or sterilising cages and accessories.

For further information on the care of animals see UFAW (1987).

Special considerations : wild animals

Animals caught in the wild or being prepared for release back into the wild should be kept in conditions that conform as nearly as possible to their natural habitat in such respects as light intensities, food, etc.

Treatment for ectoparasites is usually necessary but great care should be taken in the choice of insecticide and the method of application; such care should help minimise metabolic effects.

The progeny of wild-caught animals may be kept under normal laboratory conditions and fed pelleted diets.

For general advice on the care and use of wild animals see Schemnitz (1980) and Canadian Council on Animal Care (1984).

Special considerations : non-human primates

The Order *primates* includes both the 60g mouse lemur and the 200kg gorilla and encompasses a wide range of lifestyles. In considering the provision of suitable laboratory environment for such a widely diverse group, it is best to work from a thorough understanding of the biological needs of the individual species. Primates have a high intelligence, most have arboreal habits and all need complex, stimulating environments. Housing should provide adequate space, complexity (e.g. varied diets, cage furniture) and opportunities for social interaction.

Their use of space means that cage volume is important. Virtually all show a vertical flight reaction; cage height should allow for this and should permit the animals to stand erect, jump and climb, and to sit on a perch without head or tail touching the cage. Perches and swings may be chewed and will need periodic replacement.

No monkey should be housed in a cage any dimension of which is shorter than twice its crown/rump length. Cages should have adequate floor space for the more terrestrial species.

Most species are highly sociable and benefit from being housed with companions and should be so housed that they have social interactions. This can be achieved by careful design of single housing, paired or gang caging systems. Harmonious social

groups can be established; in some cases same-sex strangers are compatible, while in others only opposite-sex strangers can be housed together which may not be acceptable where breeding is not desired. Wherever possible caging systems should be flexible with removable walls to give access to adjacent units. If animals cannot be kept together cages should be so placed that they can see each other for at least some of the time. Intermittent social contact is better than none at all.

The least distressing method of handling is to train the animal to co-operate in routine procedures. Advantage should be taken of the animal's ability to learn; young captive-bred well-socialised specimens, which are familiar with their handlers are the most satisfactory.

All systems should be secure and present the minimum hazard to the handlers and to the animals.

Table 3.8 gives examples of caging suitable for three types of monkeys commonly kept in laboratories but the dimensions recommended may need to be adapted to individual requirements. UFAW with the support of the ABPI, has commissioned a study of housing and welfare of two species of primates most commonly used in the UK – i.e. the cynomolgus monkey, *Macaca fascicularis* and the baboon, *Papio cynocephalus*. The results of this study are expected in 1988 and may lead to reconsideration of the provisional figures given in Table 3.8.

Other considerations for the three types include the following:

Arboreal monogamous (e.g. common marmoset) – A breeding pair will produce twins or triplets every five months and the group should be permitted to increase to 6 to 8 in number. Eldest twins or triplets should be kept together to 15–18 months of age before being paired with unfamiliar partners. New pairs should not be housed in proximity to members of the same family group or breeding may be inhibited. Isolation of more than a few days should be avoided for non-breeding animals, preferably by keeping them in same-sex sibling groups.

Unfamiliar same-sex animals (even juveniles) should not be put in the same cage because they may fight.

Cages should include wooden perches – a swing, a wooden nest box, a shelf for feeding and substrate wood shavings to allow foraging. The animals should have space to jump horizontally from one perch to another.

Aboreal polygamous monkeys (e.g. squirrel monkeys) – A breeding group may consist of 1 or 2 compatible males and 6–8 females. The cage should have two compartments so that the sexes can be kept apart and females giving birth should be able to withdraw from the rest of the group. Sub-adult young can be removed and kept in gang cages in same-sex groups.

Non-breeding animals can be kept in same-sex groups. Cage inclusions should be the same as for marmosets.

Semi-terrestrial polygamous/promiscuous cercopithecoids (e.g. macaque and baboon) – A recommended breeding group is one male and 1–12 females. Females should have adequate space or means of escape should the male harass them. There should be several entrances to sleeping quarters. Groups should be monitored to check whether any individuals are being intimidated. Several food and water dispensers should be available.

Non-breeding females can be kept together. Males are highly aggressive and competitive and compatibility should be assured before housing them together.

Any animal housed individually should be assessed periodically to re-evaluate its social and environmental needs.

Table 3.1 GUIDELINES FOR HOUSING RATS IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Weight of animal g	*Minimum cage floor area sq cm per animal*		*Minimum cage height cm*
	When housed in groups	*When housed singly*	
up to 50	100	500	18
up to 150	150	500	18
up to 200	200	500	18
up to 350	250	700	20
up to 450	300	700	20
up to 550	350	700	20
over 550	400	800	20

Notes:

Cage areas and heights are the internal cage dimensions and not the overall size of the cages.

Where large, mature animals are to be housed individually, the minimum cage floor area required may be larger than above.

The cage floor area for animals housed in groups must be not less than that recommended for an animal housed singly.

See also Lawlor (1984) and Weiss & Taylor (1984).

Table 3.2 GUIDELINES FOR HOUSING MICE IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Weight of animal g	*Minimum cage floor area sq cm per animal*		*Minimum cage height cm*
	When housed in groups	*When housed singly*	
up to 30	60	200	12
over 30	100	200	12

See Notes to Table 3.1.

Table 3.3 GUIDELINES FOR HOUSING GUINEA-PIGS IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Weight of animal g	*Minimum cage floor area sq cm per animal*		*Minimum cage height cm*
	When housed in groups	*When housed singly*	
up to 150	200	700	20
up to 250	300	700	20
up to 350	400	900	20
up to 450	500	900	23
up to 550	600	900	23
up to 650	700	1000	23
over 650	750	1250	23

See Notes to Table 3.1.

Table 3.4 GUIDELINES FOR HOUSING SYRIAN HAMSTERS IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Weight of animal g	*Minimum cage floor area sq cm per animal*		*Minimum cage height cm*
	When housed in groups	*When housed singly*	
up to 60	89	300	15
up to 90	100	300	15
up to 120	120	300	15
over 120	165	300	15

See Notes to Table 3.1.

The climbing behaviour of hamsters should be taken into consideration when designing cages.

Table 3.5 GUIDELINES FOR HOUSING RABBITS IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Weight of animal kg	*Minimum cage floor area sq cm per animal*	*Minimum height cm*
up to 2	2000	40
up to 4	4000	45
up to 6	5400	45
over 6	6000	45

See Notes to Table 3.1.

Floors should be so constructed as to minimise damage to feet and hocks.

The table is based upon dwarf breeds (under 2kg), Dutch and New Zealand White (up to 6kg) and Flemish Giant (over 6kg). Area is based on cages of up to 50cm deep and to allow the animals to lie at full stretch crosswise.

Table 3.6 GUIDELINES FOR HOUSING CATS IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Weight of cat kg	*Minimum cage floor area per cat sq m*	*Minimum cage height cm*
up to 3	0.5	50
over 3	0.75	80

See Notes to Table 3.1.

For the purpose of calculating the minimum floor area, the shelf area may be included.

Cats confined in cages should be let out for exercising at least once a day where it does not interfere with the procedure. Cat pens should be equipped with dirt trays (which should be changed at regular intervals), ample shelf room for resting and objects suitable for climbing and claw trimming. Wherever practicable, cats should be housed in social groups.

Where young cats are housed singly they should be given the same size cages as cats over 3kg.

Table 3.7 GUIDELINES FOR HOUSING DOGS IN PENS, IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Weight of dog kg	*Minimum total area per dog housed singly sq m*	*Minimum total area per dog where 2 or more dogs are housed together sq m*	*Minimum pen height m*
up to 5	4.5	1.0	1.5
6– 9	4.5	1.9	1.5
10–25	4.5	2.25	2.0
26–35	6.5	3.25	2.0
over 35	8.0	4.0	2.0

See Notes to Table 3.1.

Dogs with permanent access to outside runs should have access to a sheltered place to find protection against unfavourable weather conditions. Grid floors should not be used unless a procedure requires it. Partitions between pens should be such as to minimise the risk of dogs injuring themselves or each other. All pens should have adequate drainage.

The minimum floor area for a dog pen should be 4.5 sq m. Two dogs or more may be housed in this area depending on weight. Where one dog is confined in part of this area, it should not be confined for longer than the normal overnight period.

There is always the need for dogs to have regular human contact.

Compatible dogs may be kept in pairs. Where they cannot be kept in pairs, their pens should be so placed that they can see one another, but it should be possible to prevent this when required for procedural reasons.

Whenever possible, all dogs should have access to exercise areas.

Table 3.8 PROVISIONAL GUIDELINES FOR HOUSING NON-HUMAN PRIMATES IN STOCK AND DURING PROCEDURES AND BREEDING

Type of Primate	*Weight range kg*	*No. of Animals*	*Min. cage floor area sq m*	*Min. cage height cm*
Arboreal monogamous e.g. *Callithrix*				
Non-breeding (same-sex sibs)	0.025–0.65	1–2	0.25	80
Breeding (family group)	0.30 –0.65	2–6	0.8	100
		2–8	1.0	100
Arboreal polygamous e.g. *Saimiri*				
Non-breeding	0.7 –1.4	1–2	0.5	100
		3–4	1.0	100
		8–10	1.7	150
Breeding	1.0–1.4	8–10 adults	2.0	150
Cercopithecoids* e.g. *Papio*; *Macaca*				
Non-breeding	up to 4	1	0.6	100
		2	1.2	100
	up to 6	1	0.8	110
		2	1.6	110
	over 6	1	1.4	150
		2	2.8	150
Breeding	Mixed weights	10	25.0	200
	Groups	10	25.0	200

See Notes to Table 3.1.

* See page 16 for details of further studies.

Table 3.9 GUIDELINES FOR HOUSING FERRETS AND MINK IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Weight *g*	*Minimum cage floor area per animal* *sq cm*	*Minimum cage height* *cm*
up to 800	2250	50
over 800	4500	50

See Notes to Table 3.1.

Table 3.10 GUIDELINES FOR ACCOMMODATING FARM ANIMALS IN PENS, IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Species and weights *kg*	*Minimum pen floor area when housed singly* *sq m*	*Minimum pen floor area for groups* *sq m/animal*	*Minimum length of feed rack/trough per head* *m*
Pigs			
10– 30	2.0	1.0	0.20
30– 50	2.0	1.3	0.25
50–100	3.0	1.7	0.30
100–150	4.0	2.0	0.35
over 150	5.0	3.75	0.40
Adult boar	7.5	—	0.50
Sheep and Goats			
up to 35	2.0	1.2	0.35
over 35	2.8	1.8	0.35
Cattle			
up to 60	2.2	1.3	0.30
60–100	2.4	1.7	0.30
100–150	2.8	2.0	0.35
150–200	3.6	2.4	0.40
200–400	5.7	3.6	0.55
over 400	8.0	4.8	0.65
Adult bull	16.0	—	0.65
Horses Height at withers.			
Up to 147cm (14.2 hands)	12	—	—
148–160cm	17	—	—
Over 160cm	20	—	—

See notes to Table 3.1.

Where practicable, animals should be housed within sight of each other. Where horned cattle are housed in groups, more space will be required. Horned and dehorned cattle should not be mixed in the same pen. Pens should be rectangular rather than square; the width of the pen should be not less than the length of the animal from nose to root of tail.

Table 3.11 GUIDELINES FOR CAGING BIRDS IN STOCK AND DURING PROCEDURES IN USER ESTABLISHMENTS

Species and weights g	*Minimum area for one bird sq cm*	*Minimum area for 2 birds sq cm/bird*	*Minimum area for 3 birds or more sq cm/bird*	*Minimum cage height cm*	*Minimum length of feed trough per bird cm*
Chickens & Ducks					
100–300	350	300	250	30	3
300–600	700	600	450	40	7
600–1200	1250	800	600	50	10
1200–1800	1450	950	850	50	12
1800–2400	1700	1200	1000	55	12
over 2400	2800	2000	1600	75	15
Quail					
120–140	350	250	200	20	4
150–250	400	300	250	25	4
Pigeons up to 400	1225			35	5

Notes:

"Area" means the product of cage length and cage width measured internally and horizontally, NOT the product of the floor length and floor width which may be sloping.

For definition of "cage height" see Notes to Table 3.1.

Mesh size in grid floors should not be greater than 10 × 10mm for young chicks, and 25 × 25mm for growers and adults. The wire thickness should be at the least 2mm. The sloping gradient should not exceed 14% (8°). Water troughs should be of the same length as the feed troughs. If nipples or cups are provided, each bird should have access to two. Cages should be fitted with perches and allow birds in single cages to see each other.

NB: Special care should be taken when housing chickens and quail in groups to prevent feather pecking. Where large mature birds are housed, the cages should be high enough so that the birds do not touch the top of the cage with the head.

Pigeons and finches should be housed in large aviaries wherever possible.

Animal health

General

Healthy laboratory animals are an essential prerequisite for good science. Intercurrent infection in the animal population may call in question the validity of information obtained from scientific procedures and make interpretation of results impossible.

It is essential that, in consultation with the named veterinary adviser, plans should be made to deal with possible disease outbreaks. An effective health and disease recording system should be maintained and available for inspection. It should include details of arrivals, departures, treatments and deaths.

Source and management of animals

Most laboratory species are purpose bred and healthy animals of known microbiological status can be acquired for experimental procedures. Animals from less controlled sources, such as the wild, may harbour pathogens transmissible to both man and other species. Where there is a danger of spreading disease spatial separation and suitable management procedures should be adopted to help reduce risks.

Animals that are deliberately infected with pathogens should be held at the appropriate animal containment level in accordance with the recommendations described by the Advisory Committee on Dangerous Pathogens (1984). Further information may be obtained from the Health and Safety Executive, Bootle, Merseyside.

Conventional animals

The term "conventional" is used to describe animals that are reared with a minimum barrier system and that may carry organisms pathogenic for their own or other species. Disease control in populations of such animals may be achieved by the use of appropriate vaccines or chemotherapy. Individual animals showing signs of disease should be isolated and treated or killed.

Animals that may harbour zoonotic agents should be caged, managed and handled in such a way as to minimise any risk of infection being transmitted.

Microbiologically defined animals

The objective in managing microbiologically defined animals is to ensure that their microbiological status remains the same throughout their lifetime. This can be achieved by barriers separating the animals from possible sources of infections.

Animals free from specified pathogenic organisms require to be maintained in buildings in which filtered air and treated food and water are supplied and where all caging and utensils, etc., are adequately disinfected. Personnel in such units are required to adopt hygiene standards and wear clothing that prevents them carrying infection to the animals in their care. Access of personnel to such units should be limited in order to minimise the possibility of introducing infection. Within such barrier maintained units, physical isolation of separate experimental populations is recommended in order further to reduce the risk of introducing disease. Regular microbiological surveillance is necessary to ensure that the status is being maintained.

Gnotobiotic animals need complete physical separation from environmental contaminants and isolation techniques are essential (Coates & Gustafssen, 1984).

4. HUMANE KILLING OF ANIMALS

Standard methods of humanely killing laboratory animals are listed in Schedule 1 to the 1986 Act. Killing a protected animal for scientific purposes at a designated establishment does not require a licence if a method listed in Schedule 1 as appropriate to the animal is used; however if some other method is used the killing becomes a regulated procedure and requires the authority of a personal and a project licence.

If the animal is no longer under experiment but is suffering or is likely to suffer adverse effects, then under Section 15 of the Act the person who applied the regulated procedures to the animal, or the last of them, must cause the animal to be killed immediately by an appropriate method under Schedule 1 or as authorised by their personal licence.

Where an animal has not been or is no longer under experiment, is not suffering or likely to suffer adverse effects, but nonetheless it is desired to kill the animal, the method must be either one appropriate to the animal in Schedule 1 or a method that is otherwise approved by the Home Secretary under Section 10.5.

The Schedule must be consulted to check that the methods given below are appropriate for the species and weights of animals concerned.

Wherever practicable animals to be killed should be removed from the presence of others and handled carefully to ensure that they are not frightened or antagonised. Methods that are not instantaneous should be induced as quickly as possible with minimum stress, and unconsciousness should be fully maintained until death. Death must be ensured by physical checks or by exsanguination, severance of the major blood vessels or ventricles of the heart, and confirmed, *before disposal of the body*. Only trained personnel should be allowed to kill animals.

Methods of euthanasia

Inhalation of carbon dioxide (CO_2)

Suitable for small rodents and birds; animals should be exposed to an atmosphere of 30 per cent CO_2 (to ensure loss of consciousness) which is then increased to 70 per cent to kill the animals. This may be achieved by placing the animal in an airfilled container and then allowing the gas to flow into it so that the concentration rises to at least 70 per cent and is maintained there for at least 3 minutes. Animals may be left in the container until *rigor mortis* is observed, or they may be removed and death ensured by exsanguination or dislocation of the neck, and confirmed dead. Neonatal animals require longer exposure than adult animals.

Inhalation of volatile anaesthetic

A prolonged exposure leading to an overdose is suitable for small rodents; when using an anaesthetic overdose there should be no contact between the animal and the anaesthetic in its liquid form. The procedure should always be carried out in a fume cupboard or a well ventilated area so that the operator is not subjected to prolonged exposure to the vapour fumes.

Injection of anaesthetic

Suitable for all species and the method of choice for larger species; an overdose should

be administered intravenously or intraperitoneally and be sufficient to ensure rapid unconsciousness and death.

Exsanguination
Exsanguination under deep anaesthesia may be allowed but it is not a Schedule 1 method and therefore will require the authority of a project licence.

Physical methods

Dislocation of cervical vertebrae – suitable for small rodents, small rabbits and larger birds (UFAW, 1978).
Concussion by striking the back of the animal's head. This method is restricted to animals that are handled easily and that have relatively thin skulls, i.e. small rodents and smaller birds.
Decapitation used for rodents where other methods would be unsuitable, e.g. where enzyme levels are to be determined. This method must only be carried out using a specially designed and properly maintained guillotine. This is not a Schedule 1 method, except for cold-blooded vertebrates.

Farm animals
When appropriate and with the prior permission of the Home Office Inspector, arrangements may be made to send animals to a licensed slaughterhouse. If animals are to be killed on site the following methods may be used as an alternative to injection of anaesthetic. They are not Schedule 1 methods.

Cattle – Captive bolt stunning followed by exsanguination or destruction of the brain and spinal cord.
Horses – Humane killer using a free bullet. If used correctly, the horse drops dead immediately and no further action is required. If breathing persists, a second shot may be necessary.
Sheep and goats – Exsanguination after captive bolt or electrical stunning.
Pigs – Up to 70kg liveweight, electrical or captive bolt stunning followed by either destruction of the brain and spinal cord or exsanguination. For heavier pigs low voltage electrical stunning is not suitable.

Fish
Under Schedule 1 fish may be killed by a sharp blow to the head followed by destruction of the brain. Although not a requirement under Schedule 1, electronarcosis or galvonarcosis may be used to immobilise the fish which can then be killed.

If undamaged carcasses are required an overdose of anaesthetic may be added to the water followed by destruction of the brain (see Tytler & Hawkins, 1981).

Amphibians and reptiles
Where possible, an overdose of an anaesthetic agent should be used. When cold-blooded vertebrates are killed by decapitation the brain should be destroyed immediately.

For further information on euthanasia of all species see AVMA Panel (1986).

Disposal of dead animals

Laboratory animals
It is essential to ensure that the animal is dead before disposal. The animals must be kept and observed for several minutes after all signs of life have ceased. Alternatively, the animal's neck should be dislocated or the animal may be exsanguinated. Preferably animals should be disposed of on site by incineration. If this is not possible, care should be taken to prevent exposure of the carcasses to the general public. Infected, toxic or radioactive carcasses must be disposed of in such a manner that they do not present a hazard.

Farm animals
Carcasses may be disposed of, whenever practical, to a licensed animal by-products processor. Infected, toxic or radioactive carcasses must be disposed of in such a manner that they do not present a hazard.

5. CONCLUSION

It is an underlying principle of the 1986 Act that animals bred, supplied and used for scientific purposes should be cared for in accordance with the best standards of modern animal husbandry. It is hoped that these guidelines on housing and care will help to establish such standards.

Although sizes of cages and pens are recommended, from the animal's point of view cage shape and furniture may be more important than size and the social relationship of its fellows more important than stocking densities. The care given by staff may be the most important factor of all.

Knowledge of the needs of animals is always growing and it is necessary that it continues to be shared. Breeders are very willing to provide details of the high quality animals they supply; licensees, technicians, animal house curators and veterinary surgeons responsible for the care of the animals should share their experiences and knowledge and, if needs be, seek advice from the Home Office Inspectorate. It is up to all concerned to keep themselves fully aware of developments that might improve the standards of husbandry of the laboratory animals in their care.

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2ND ERRATUM TO

GUIDELINES ON THE CARE OF LABORATORY ANIMALS AND THEIR USE FOR SCIENTIFIC PURPOSES

1. Housing and Care

Page 13: **Animal accommodation** 5th para **surface** should read **surfaces.**

Page 18: **Table 3.4** Guidelines for housing syrian hamsters in stock and during procedures in user establishments. In column headed

When housed in groups amend figure **89** to read **80.**

Page 22: **Table 3.11** Guidelines for caging birds in stock and during procedures in user establishments. In column headed

Species and weights g under **Quail** amend figures **120-140** to read **120-150.**

24th August 1987