F. Species specific guidelines for non-human

a. General considerations

1. Introduction

Keeping non-human primates for research purposes creates a number of problems which are not shared with other commonly used mammals used in research. Non-human primates are not domesticated, but are wild animals; most are also arboreal. Their wild status means that they are more alert than domesticated species and thus are highly reactive to any unfamiliar and alarming stimuli. Unlike domesticated species, they have not been selected for friendliness to humans and low aggression. Early friendly contact between infants and care-givers will result in a less fearful animal, as the animals learn that familiar humans do not constitute a threat, but the animals will retain most of the attributes of their wild conspecifics. In contrast to non-arboreal mammals, the flight reaction of non-human primates from terrestrial predators is vertical, rather than horizontal; even the least arboreal species seek refuge in trees or on cliff faces. As a result, enclosure height should be adequate to allow the animal to perch at a sufficiently high level for it to feel secure. The structural division of space in primate enclosures is of paramount importance. It is essential that the animals should be able to utilise as much of the volume as possible because, being arboreal, they occupy a three-dimensional space. To make this possible, perches and climbing structures should be provided.

In addition to their wild nature and climbing habits, non-human primates have advanced cognitive capabilities and complex foraging and social behaviour. As a result, they require complex, enriched environments to allow them to carry out a normal behavioural repertoire. The group structure, however, should be such that normal behaviours indicative of distress or pain or those likely to result in injury are kept to a minimum.

Non-human primates used for scientific research should be captive-bred and, where practicable, reared on site to avoid transport stress. Captive-bred animals

are of known age, parentage and health status and have been reared under standardised husbandry practices. Where non-human primates are to be imported they should, whenever possible, be obtained as offspring from established breeding colonies with high welfare and care standards similar to those outlined in the Codes of Practice issued by the International Primate Society (IPS) International Guidelines for the acquisition, Care and Breeding of Non-human Primates. They should be free from zoonotic diseases. Wild caught animals should only be used in exceptional circumstances as they present health hazards to staff, have unknown histories and are likely to be more afraid of humans. In some instances there can be a significant mortality among the animals at the trapping site and during transfer to the source country holding site.

Additional details are provided for the commonly bred and used laboratory species. Further advice on requirements for other species (or if behavioural or breeding problems occur) should be sought from experienced primatologists and care staff and discussed with the competent authority to ensure that any particular species needs are adequately addressed.

2. The environment and its control

2.1. Ventilation

(See paragraph 2.1. of the General section)

2.2. Temperature

As in captivity the animals have restricted opportunities for natural behavioural means of coping with climatic change, the ranges specified for animals will not necessarily reflect those which they experience in nature. Generally the ranges will be those which are optimal for the animals and comfortable for staff. Where outdoor enclosures are in use, it is essential to provide shelter from inclement weather for all individuals and continuous access to adequate heated indoor accommodation. This is of particular importance in breeding colonies with extensive outdoor enclosures to reduce the risk of frostbite and loss of neonates in the winter months.

2.3. Humidity

Although some non-human primates live in tropical rain forests, where humidity is high, and others in arid regions, it is not necessary for this to be replicated in facilities for established colonies. In general, humidity levels of 40 to 70% relative humidity are comfortable for both animals and care staff. Care should be taken (see individual species) not to expose the animals to humidity which is too low and prolonged exposure outside this range should be avoided, particularly for New World monkeys, which may be susceptible to respiratory problems.

2.4. Lighting

Most non-human primates should have a 12hour/12hour light/dark cycle. Simulated dawn and dusk lighting may be beneficial for some species. It will minimise the risks of injury caused to animals if they are startled by a sudden change in light intensity. For the nocturnal species, such as *Aotus trivirgatus*, the cycle should be modified so that dim red light is used during part of the normal working day to allow the animals to be observed during their active periods, and also to enable routine husbandry tasks to be carried out safely. Whenever possible, rooms housing non-human primates should be provided with windows, since they are a source of natural light and can provide environmental enrichment.

2.5. Noise

Restful background sound such as music or radio programmes provided during the day can act as a form of environmental enrichment and help to screen out sudden loud noises but it should not be provided permanently. Music may also have a calming effect on the animals in times of stress. For most species, satisfactory sound levels will be the same as those recommended for staff, but some species such as callitrichids can also hear ultrasound, so this should be taken into account. The level of background noise should be kept low and should only exceed 65 dBA for short periods so that vocal communication between animals is not inhibited.

2.6. Alarm systems

Most higher non-human primates have similar hearing to humans; to avoid frightening the animals, sirens should be avoided. An appropriate alternative would be to use flashing lights visible to staff in all rooms.

3. Health

Though the use of captive-bred animals should ensure that they are in good health and do not pose a risk of infection to staff or other non-human primates in the premises, all newly acquired animals should arrive with full health certification and be quarantined on arrival. During this period their health should be closely monitored and further serological, bacteriological and parasitological tests should be performed by competent laboratories as required.

All non-human primates in the colony should be under expert veterinary control and submitted to periodical health screening. Their close affinity to humans results in susceptibility to a number of diseases and parasites that are common to both and occasionally life threatening to the other. It is, therefore, of vital importance that there is also regular medical screening of the staff. Any member of staff posing a potential health risk to the animals should not have contact with the animals. Particular care should be taken when dealing with animals which may be contaminated by pathogens transmissible to humans. Staff should be informed, and measures taken to minimise the risk of infection. Lifetime health records should be kept for each animal. The investigation of unexpected morbidity and mortality should be thorough, having regard for potential zoonotic diseases, and be entrusted to competent personnel and laboratories.

Plans to prevent or deal with possible disease outbreaks should be prepared in consultation with the [designated veterinarian]. An effective health monitoring system should be maintained and be available for inspection. All animals should be observed daily for signs of illness or injury and observed for psychological well-being by an experienced animal care person familiar with the species. Individual animals showing evidence of disease or injury which warrants isolation must be removed and given appropriate treatment.

Non-human primates from different geographical areas should be strictly separated from each other until their health status has been ascertained. Physical separation of animals by species is generally recommended to prevent inter-species disease transmission and to reduce the stress caused by inter-species conflict. New World, Old World African and Old World Asian non-human primate should be housed separately as latent infections in one group can cause serious clinical disease in others.

In outdoor enclosures, vermin control is of particular importance.

4. Housing, enrichment and care

4.1. Housing

A person competent in the behaviour of non-human primates should be readily available for advice on social behaviour, environmental enrichment strategies and management.

Because the common used non-human primates are social animals, they should be housed with one or more compatible conspecifics. To ensure harmonious relations, it is essential that the group composition of non-human primates should be appropriate. Compatibility, and hence group composition, in terms of the age and sex of its members depends on the species. In creating groups, the natural social organisation of the species should be taken into account. In confined conditions, however, where the space for extended chases or the emigration of social rejects is not available, the natural age and sex composition of troops may be inappropriate, modifications to group structure may be required. For example, a harem structure may be substituted for the natural multi-male, multi-female troop in macaques. Experimental protocol may also determine group composition, for example, single-sex or same age groups. Visual barriers, which allow the animals to be out of sight of one another, are important in group housing and multiple escape routes provide opportunities to avoid attacks and also prevent dominant individuals from restricting access of subordinates to other parts of the enclosure.

Careful monitoring of animals is necessary following grouping or mixing, and a programme of action should be in place for managing and minimising aggressive interaction.

Where animals are housed in same-sex groups, it is best to avoid housing the two sexes in close proximity, as this can sometimes lead to the males becoming aggressive. The only exceptions to social housing should be either for veterinary reasons or where an experimental protocol demands it to ensure good science. Where socially housed animals need to be separated for a period of time, for example, for dosing *or* for veterinary treatment, care and vigilance should be exercised on re-introduction as the social organisation in the group may have changed and the animal may be attacked. Possible solutions include confinement of this animal to an individual enclosure attached to, or within, the main living area or separation of all individuals briefly followed by re-introduction of the whole group simultaneously.

4.1.1. Breeding

The sex ratio and numbers of animals in a breeding colony will depend on the species involved. It is important to ensure that both space and complexity are adequate to prevent the intimidation of individuals, particularly low-ranking females and young. Multiple food and water sites should be available. In polygamous species, the sex ratio should ensure that the majority of females are mated and give birth to live offspring. Where there is more than one male in the group, care should be taken to ensure that the males are compatible. Monogamous species will be bred in family groups with a breeding pair and two or more sets of their offspring.

For future breeding animals, it is important that the young grow up in stable social groups, preferably their natal group, with their mothers. This ensures that their parenting skills and social interactions within a hierarchical structure develop adequately.

Animals will normally successfully rear single or twin offspring without intervention. However, a management policy for rejected infants is required to minimise suffering in these animals.

4.1.2. Separation from the mother

Young animals have a slow postnatal development lasting several years in cercopithecoids with a period of dependency on their mothers lasting until they are 8 to 12 months old, depending on the species. During this period they learn about their environment under the mother's protective vigilance and socialise through interactions with a diversity of social partners.

They also learn parenting skills by interacting with infants or even helping to care for them. Separation of infants from a colony causes distress to the mother and infant at the time. It is therefore preferable to leave them in their natal colony until they have become independent. Should they, for their own welfare, have to be weaned or separated earlier, it is advisable to incorporate them into a well organised group to avoid damage to their social development, behaviour, physiology and immune competence. The appropriate age ranges for weaning will depend on the species. Weight, health and behavioural criteria should be used to determine the most appropriate weaning age for the welfare of each individual monkey.

4.2. Enrichment

The environment should enable the animal to carry out a complex daily programme of activity. The precise features of the living quarters, however, will vary according to species, due to differences in natural behaviour. The enclosure should allow the animal to adopt as wide a behavioural repertoire as possible, provide it with a sense of security, and a suitably complex environment to allow the animal to run, walk, climb and jump. Materials providing tactile stimuli are also valuable. Opportunities for the animals to have some control over the environment should be provided. Some novelty should also be introduced at intervals, which can include for example minor changes in the conformation or arrangement of enclosure furniture and feeding practices.

4.3. Enclosures – dimensions and flooring

Non-human primates should be housed in such a way that they do not exhibit abnormal behaviour and are able to display a satisfactory range of normal activities.

The following factors will determine the enclosure dimensions for a given species:

- the adult size of the animal (juvenile animals, though smaller, are usually more active than adults, thus requiring similar space allowances for physical development and play); and
- sufficient space to provide a complex and challenging environment; and
- the size of group to be accommodated.

4.3.1. Dimensions

The following principles should apply to the housing of all species of non-human primates:

- enclosures should be of adequate height to allow the animal to flee vertically and sit on a perch or a shelf, without its tail contacting the floor *or* head touching the roof of the cage;
- the animal should be able to display a normal locomotor and behavioural repertoire;
- there should be room for suitable environmental enrichment;
- apart from exceptional circumstances, the animal should not be singly housed;
- enclosures should not be arranged in two or more tiers vertically.

4.3.2. Outdoor enclosures

Where possible, non-human primates should have access to outdoor enclosures. These are commonly used for breeding larger non-human primates. They have the advantage for the animals that they can include many features of the natural environment and are also useful for holding stock or experimental animals where close climatic control is not required and outdoor temperatures are suitable. Outdoor enclosures are usually constructed of metal, but other materials, including wood, can be used providing it is suitably weather-proofed. Some types

of wood are approved by toxicologists provided that a certificate of analysis is available. Wood is easily maintained or replaced, can be custom-built on site and provides a quieter and more natural material. To protect the structural integrity of a wooden enclosure, the framework should either be of a type of wood which the animals will not chew or protected with mesh and a non-toxic treatment. The base of the enclosure can be of concrete or natural vegetation. Concrete-floored enclosures can be covered with a suitable non-toxic substrate. Either part of the outdoor enclosure should be roofed, to allow the animals to be outside in wet weather and to provide protection from the sun or, alternatively, shelters can be provided. Where outdoor enclosures are provided, the non-human primates will utilise them, even in the winter. However, heated indoor enclosures should be provided. It is recommended that the minimum size for an indoor enclosure should meet the minimum values specified to ensure that the animals are not overcrowded in inclement weather. As outdoor enclosures represent additional space, there is no need to set minimum dimensions for these. Where different enclosures are connected, for example outdoor and indoor, more than one connecting door should be provided to prevent subordinates being trapped by more dominant animals.

4.3.3. Indoor housing

Although indoor enclosures will commonly be constructed of metal, other materials, such as wood, laminates and glass have been used successfully and provide a quieter environment.

As height is a critical feature of the enclosure, all non-human primates should be able to climb, jump and occupy a high perch. The walls can include mesh to allow climbing but sufficient diagonal branches or perches should also be provided to allow all animals to sit on them simultaneously. Where mesh *or* horizontal bars are used, care should be taken to ensure that they are of a type which could not lead to injury through animals having their limbs trapped.

Solid floors have the advantage that they can be covered with a substrate in which food can be scattered to encourage foraging. Non-human primates require space for activity, but may need to be confined in smaller home enclosures for

short periods of time when justified on veterinary or experimental grounds. Smaller volumes can be created by partitioning the main enclosure using dividers and/or a mobile back to the enclosure, having a cage within the home enclosure, two linked units, or attaching experimental enclosures to a larger exercise enclosure. These methods of confining animals all have the advantage that animals have access to a satisfactory living environment and social companions, allowing however separation for feeding, cleaning and experimental purposes, such as dosing and blood sampling.

More space for activity can be provided by keeping non-human primates in large groups, rather than pairs. Individuals can be isolated when required by training (see paragraph 4.8 below) or running the group through a race with a trap in it.

The additional provisions provide minimum recommended enclosure sizes for the different species.

4.4. Feeding

Presentation and content of the diet should be varied to provide interest and environmental enrichment. Scattering food will encourage foraging, or where this is not possible food should be provided which requires manipulation, such as whole fruits or vegetables, or puzzle-feeders can be provided. Foraging devices and structures should be designed and situated to minimise contamination. Vitamin C is an essential component of the primate diet. New World monkeys also require adequate quantities of vitamin D3. As the enrichment feeding may lead to preferences, to ensure that the animals receive a balanced diet it is advisable to feed the standard diet first thing in the morning when the animals are hungry and when no alternative *is* offered. The food should be scattered to ensure that it is not monopolised by dominant individuals. A varied diet should be provided unless it is likely to have disturbing effects on experimental results. However, in such circumstances variation can be introduced in the form of nutritionally standard diets available in different shapes, colours and flavours.

4.5. Watering

(See paragraph 4.7. of the General section)

4.6. Substrate, litter, bedding and nesting material

Some non-human primates, for example some prosimians, require nesting material, for example wood wool, dry leaves or straw. Non-toxic substrates such as wood chips, wood granulate with a low dust level or shredded paper are valuable to promote foraging in indoor enclosures. Grass, herbage wood chip or bark chip are suitable for outdoor facilities.

4.7. Cleaning

(See paragraph 4.9. of the General section)

4.8. Handling

Various methods of restraint are employed in handling non-human primates, ranging from enclosures with sliding partitions, through netting, holding the animals manually, to using a dart to tranquillise them. Although non-human primates dislike being handled and are stressed by it, training animals to co-operate should be encouraged, as this will reduce the stress otherwise caused by handling. Training the animals is a most important aspect of husbandry, particularly in long-term studies. It has a dual advantage in providing the animal with an intellectual challenge and making work more rewarding for the care-giver. Non-human primates will respond to aural and visual stimuli, and by using simple reward systems, training can often be employed to encourage the animals to accept minor interventions, such as blood sampling.

The response of individuals to training and procedures should be regularly reviewed, as some animals may be particularly difficult or non-responsive and in such cases, careful consideration should be given to their continued use.

Though animals can be trained to accomplish tasks, attention should be paid to appropriate recovery periods when subjected to repeated experiments.

4.9. Humane killing

(See paragraph 4.11. of the General section)

4.10. Records

Individual records containing detailed information for each animal should be maintained. These should include: species, sex, age, weight, origin, clinical and diagnostic information, present and previous housing system, history of experimental use and any other information relevant for management and experimental procedures, such as reports on their behaviour or status, and favoured social companions/social relationship.

4.11. Identification

All non-human primates in a facility should be identified with a permanent and unique identification code before weaning. Individual animals can be identified visually by using properly fitted necklaces with attached medallions or tattoos for large species. Animals should be sedated for the purposes of tattooing as this will reduce stress in the animals and reduce the risk of injury to the handler. Microchips can be injected into accessible sites (the wrist for larger animals or scruff of the neck for smaller species). As it is important to be able easily to distinguish animals, some laboratories successfully use names for the animals, as these can easily be used to identify dominant and subordinate animals, and are considered by some to encourage the care staff to increase their respect for the non-human primates. Ear notching or other mutilations should not be used.

5. Training of personnel

Staff should be trained in the management, husbandry and training of animals under their care. For animal carers and scientists working with non-human primates, training should include species-specific information. This should include the biological, psychological and behavioural characteristics and requirements of the species, environmental enrichment, methods used for the introduction and removal of animals and social dynamics. Comprehensive training and supervision should be provided by experienced, competent staff only. It should include the catching and handling of non-human primates in a safe and humane manner, methods of restraint and humane methods of killing.

Training should also include information on the health and safety of staff working with non-human primates including zoonotic disease risk, management and security.

6. Transport

Animals should, where possible, be transported in compatible pairs. Juvenile monkeys should not be separated from one another as this increases stress. If this is not feasible they should be transported in partitioned containers or in separate containers loaded adjacent to each other. However, adult animals may need to be transported singly. Monkeys of the same species and sex may be transported together in the same container only if they have previously been shown to be compatible.

Transport of non-human primates must comply with the International Air Transport Association's Regulations relating to live animals including the design and construction of containers.

6.1 Receipt

Animals must be removed from their transport containers soon after they arrive. Particular care should be taken during handling at this time to minimise the stress caused to the animal and to guard against escapes. After inspection they must be transferred to their home enclosure, and be provided with food and water without delay. Where possible food of a type familiar to them should be offered and new diets introduced gradually.

Sick or injured animals must receive prompt veterinary attention. Where animals have died during transit or soon after arrival a post-mortem examination should be performed to ascertain the cause of death. The supplier should be informed and action taken to minimise the risk of any recurrence. A record must be made of each individual animal received, including its source, date of arrival and health status.

A period of acclimatisation is necessary to enable animals to recover from any transport stress and to become accustomed to their new environment. The required acclimatisation period will vary with the species, the journey and the facilities available. Imported animals are subjected to other statutory control.

6.2 Despatch

Non-human primates fear unfamiliar environments encountered during transport. There are a number of basic principles which the carrier should follow in order to ensure the welfare and comfort of the animal and which will influence the animal's behaviour during transport. Stress may cause the animal to become difficult to manage. It is natural for monkeys to investigate their surroundings and try to escape. With very few exceptions, monkeys do not willingly accept confinement and will often make determined efforts to escape. Familiarisation with the transport box prior to travel can reduce stress to the animal. Transport containers must be of a suitable design and construction to minimise risk of escape. Vehicles used for transport should have two sets of doors/gates into the animal compartment, with a viewing port in the inner door.

Transportation of monkeys suckling young should not normally be undertaken. Some females, sensing danger, may harm their young. However, if in exceptional circumstances nursing monkeys have to be transported, they should be carried together with their young but separated from other members of the group.

Food and moisture must be provided. It is recommended that a small quantity of fresh fruit or vegetables is put in the container during packing.

Most species can withstand reasonable variations in temperature but exposure to wind in combination with cold can be fatal. Consideration therefore must be given not only to the temperature fluctuations but also to the chill factors involved. Monkeys should never be exposed to direct heat, for example by placing them in direct sunlight or against hot radiators from where they are unable to escape.

b. *Additional guidelines for housing and care of marmosets and tamarins*

1. Introduction

Marmosets (*Callithrix spp*.) are small, highly arboreal, South American diurnal non-human primates. In the wild they have home ranges of 1 to 4 hectares where they live in extended family groups of three to fifteen animals consisting of a breeding pair and their offspring. Females produce litters twice a year (normally twins and in captivity, not infrequently, triplets) and all group members take care of the offspring. Reproductive inhibition of the subordinate females by the dominant occurs due to hormonal and behavioural mechanisms. Marmosets are frugivore-insectivore and are specialised in gum-tree gouging and gum feeding; however, in captivity they would gouge and scent-mark other hardwoods. Foraging and feeding occupy up to 50% of the time available. Marmosets and tamarins can live for up to fifteen to twenty years in captivity.

Tamarins (*Saguinus spp*.) are similar to marmosets in many respects. They are found in South and Central America, but are slightly larger animals and have larger home ranges, varying from 30 to 100 hectares. The larger home ranges of tamarins are related to more frugivorous diets, while they do not gouge, and eat gum only when readily accessible.

Most marmosets and tamarins show reluctance to descend to the ground and frequently scent-mark their environment.

2. The environment and its control

2.1. Ventilation

(See paragraph 2.1. of the General section)

2.2. Temperature

Marmosets and tamarins should be maintained in a temperature range of 23°C to 28°C, although levels slightly higher are acceptable due to the tropical nature of the animals. Wide fluctuations should be avoided.

2.3. Humidity

Humidity levels of 40 to 70% should be provided, although the animals will tolerate relative humidity levels higher than 70%. Low levels of relative humidity should be avoided.

2.4. Lighting

A photoperiod of no less than twelve hours of light is recommended. The lighting source should illuminate uniformly the holding room and permit adequate observation of the animals. However, within the animal enclosures, a shaded area should always be provided.

2.5. Noise

Special consideration should be given to minimise exposure to ultra-sound, which is within the hearing range of marmosets and tamarins.

2.6. Alarm system

(See paragraph 2.6. of the General considerations for non-human primates)

3. Health

(See paragraph 3 of the General considerations for non-human primates)

4. Housing, enrichment and care

4.1. Housing

Marmosets and tamarins should be housed in family groups consisting of unrelated male-female pairs and one or more sets of offspring. Groups of stock animals should consist of compatible same-sex peer individuals or juveniles. Care should be taken when grouping unrelated adult individuals of the same sex since overt aggression may occur.

During experiments, marmosets and tamarins can generally be kept with a compatible same-sex animal (twins, parent/offspring) or in male-female pairs, using contraception. When experimental procedures or veterinary care require

single housing, the duration should be minimised and the animals should remain in visual, auditory and olfactory contact with conspecifics.

Breeding pairs should be formed only when the animals are aged about 2 years. In family groups, the presence of the mother will inhibit the ovulatory cycle in her female offspring. New pairs intended for breeding should not be kept close to the parental family since reproduction may be inhibited.

The appropriate age of weaning will depend on the intended use of the animals but should not be earlier than 8 months of age. When animals are to be used as breeders, they should remain in the family group until at least 13 months of age in order to acquire adequate rearing experience.

4.2. Enrichment

The natural behaviour of marmosets and tamarins indicates that the captive environment should provide some degree of complexity and stimulation, factors which are more valuable than simply increasing enclosure dimensions to promote species-typical behaviour. Furniture of natural or artificial materials (for example, wood, PVC) should include: perches, platforms, swings, ropes. It is important to provide a certain degree of variability in orientation, diameter and firmness to allow the animals to perform appropriate locomotor and jumping behaviours. Wooden perches allow marmosets and tamarins to express their natural behaviour of gnawing followed by scent-marking. In addition, a comfortable secure resting area such as nest boxes should be included since they are used for resting, sleeping and hiding in alarming situations. Though visual contact between family groups is normally stimulating for the animals, opaque screens and/or increasing the distance between enclosures in order to avoid territorial interaction may be needed in some cases, and in particular for certain callitrichid species. Foraging devices, which stimulate the natural behaviour of the animals, should be suspended or presented in the upper part of the enclosure, in consideration of the reluctance of the animals to descend to ground level. Wood chips as a substrate will encourage foraging of spilled food at the floor area. In general, the inclusion in the lower part of the enclosure of structural elements and enrichment devices will promote a wider and more

diversified use of the space. For marmosets, which are specialised in tree-gnawing to obtain gum, sections of dowel drilled with holes and filled with gum arabic have proved very beneficial.

4.3. Enclosures – dimensions and flooring

For marmosets and tamarins the volume of available space and the vertical height of the enclosure are more important than floor area, due to the arboreal nature and the vertical flight reaction of these species. The minimum dimensions and design of the enclosure should take into account the purpose for which the animals are maintained (breeding, stock, short or long experiments) and enable the inclusion of sufficient devices for improving the environmental complexity.

Table F.1. Marmosets and Tamarins: Minimum enclosure dimensions and space allowances

	Minimum floor area of enclosure for 1* or 2 animals plus offspring up to 5 months old (m^2)	Minimum volume per additional animal over 5 months (m^3)	Minimum enclosure height (m) **
Marmosets			1.5
Tamarins	1.5	0.2	1.5

* Animals should only be kept singly under exceptional circumstances (see paragraph 4.1).

** The top of the enclosure should be at least 1.8m from the floor.

4.4. Feeding

Marmosets and tamarins require a high protein intake and since they are unable to synthesise vitamin D3 without access to UV-B radiation, the diet must be supplemented with adequate levels of vitamin D3.

4.5. Watering

(See paragraph 4.7. of the General section)

4.6. Substrate, litter, bedding and nesting material

(See paragraph 4.6. of the General considerations for non-human primates)

4.7. Cleaning

Marmosets and tamarins frequently scent-mark their environment and the total removal of familiar scents may cause behavioural problems. Alternate cleaning and sanitation of the enclosure and the enrichment devices retains some of the territorial scent-marking and has beneficial effects on the psychological well-being of the animals, reducing over-stimulated scent-marking.

4.8. Handling

Regular handling and human contact are beneficial for improving the animals' habituation to monitoring and experimental conditions and facilitate training to cooperate with some procedures. When capture and transport of the animals are required, nest boxes can be used to reduce handling stress.

4.9. Humane killing

(See paragraph 4.11. of the General section)

4.10. Records

(See paragraph 4.10. of the General considerations for non-human primates)

4.11. Identification

(See paragraph 4.11. of the General considerations for non-human primates)

5. Training of personnel

(See paragraph 5 of the General considerations for non-human primates)

6. Transport

(See paragraph 6 of the General considerations for non-human primates)

c. Additional guidelines for housing and care of squirrel monkeys

1. Introduction

Squirrel monkeys (*Saimiri spp*.) inhabit the tropical rain forests of the South American continent at various altitudes. There are various regional subspecies, the two most important are known as *S. sc. boliviensis* (black headed) and *S. sc. sciureus* (olive). In addition to differences in coat colour and face masks they also have some minor variations in behavioural characteristics. Body weight of adults ranges from 600 to 1100 g, with males being distinctly heavier than females. Standing upright, adult animals reach about 40cm body length. They are typically arboreal animals living at different levels of the canopy, depending on environmental temperature. They do, however, descend to the ground to look for food and, and in the case of young animals, to play. When in danger, they flee to a high level. When travelling they may take leaps depending on the density of the canopy. In the wild they live in fairly large groups in which females and young animals live together with a dominant breeding male, whereas adult males that are not in breeding condition remain on the periphery, forming groups of their own. Squirrel monkeys in captivity have been known to live for up to twenty-five years.

2. The environment and its control

2.1. Ventilation

(See paragraph 2.1. of the General section)

2.2. Temperature

Though the species live in a wide range of climatic conditions in tropical forests from low to high altitudes in mountain areas, temperature changes in the habitats of individual colonies or troops do not vary greatly. Therefore marked short-term temperature variations should be avoided. In the wild the animals adapt to ambient temperatures by choosing the most suitable level within the canopy (for example, nearer to the ground in cool weather). Whereas normal room

temperatures of 22°C to 26°C seem to be adequate, for animals with restricted exercise areas temperatures around 26°C may be more appropriate.

2.3. Humidity

A range of 40 to 70 % is adequate for this species.

2.4. Lighting

As tropical-forest dwellers, squirrel monkeys are adapted to diffuse lighting. Nevertheless, for animals without access to outdoor enclosures, areas with high intensities of light similar to daylight should be provided. The light spectrum should resemble daylight even though the light intensity need not be that of bright sunshine. A 12 hour/12hour light and dark cycle is appropriate. The daylight period should not be less than eight hours. The addition of a UV component or time-limited exposure to UV lamps would enable essential vitamin D3 synthesis in skin.

2.5. Noise

(See paragraph 2.5. of the General considerations for non-human primates)

2.6. Alarm systems

(See paragraph 2.6. of the General considerations for non-human primates)

3. Health

Squirrel monkeys may be silent carriers of a herpes virus (Saimirine herpesvirus 1, syn. Herpesvirus tamarinus, herpes T, Herpesvirus platyrrhinae), which, when transmitted to marmosets, may prove fatal. It is, therefore, recommended to not keep these two animal species in the same units unless tests have shown the colonies to be free from this viral infection.

4. Housing, enrichment and care

4.1. Housing

Based on their natural social organisation there is no difficulty in keeping saimiris in large single-sex groups. For this purpose, however, male and female groups should be well separated to avoid fighting. Special attention should be paid to identify distressed individuals in a group since aggressive behaviour is not very pronounced in squirrel monkeys.

For breeding purposes a group of seven to ten females kept with one or two males appears to be adequate. In captivity breeding groups should consist of a minimum of three females, as smaller numbers do not show regular reproductive cycling. Breeding groups should have visual contact, but should be prevented from physical contact, with other groups.

Newborn animals are carried on the backs of their mothers until they are about 6 months old. However, they leave their mothers for exploration or are carried by close relatives at quite an early stage. They thus learn to socialise and, frequently through vocalisations, discover what may be dangerous or beneficial for them. The animals take up solid food from the age of three months onward. Nevertheless it is recommended that young animals should not be separated from their families before 9-10 months of age or, if hand feeding is necessary, they can be placed for adoption by another female, if possible, in their natal group. Squirrel monkeys reach sexual maturity at about the age of 3 years.

Breeding groups, once established, should not be disturbed, to avoid reduction in breeding performance. Major environmental and social changes should thus be avoided.

4.2. Enrichment

As arboreal animals, squirrel monkeys need sufficient climbing possibilities which can be provided by wire-mesh walls, poles, chains or ropes. Though they do leap over gaps if provided with structures, they prefer to run along or swing on

horizontal and diagonal branches or rope bridges. Perches or nest boxes where they can sit huddled together for resting and sleep will be utilised.

A solid base with a substrate encourages foraging activity and play. The animals should be offered a choice of sites within the enclosure to allow for activity, to enable them to retreat from social contact and to allow them to select comfortable temperatures and lighting conditions. Facilities should be provided for females giving birth to withdraw from the rest of the group.

4.3. Enclosures – dimensions and flooring

Table F.2. Squirrel Monkeys: Minimum enclosure dimensions and space allowances

Minimum floor area for 1* or 2 animals (m^2)	Minimum volume per additional animal over 6 months of age (m^3)	Minimum enclosure height (m)
2.0	0.5	1.8

* Animals should only be kept singly under exceptional circumstances (see paragraph 4.1). Squirrel monkeys should preferably be kept in groups of 4 or more animals.

4.4. Feeding

Squirrel monkeys require a high protein intake and standard monkey diets are generally inadequate in this respect and require supplementation. As with other South American species, squirrel monkeys require high levels of vitamin D3 in addition to vitamin C. Pregnant females are susceptible to folic acid deficiency, and should be provided with an appropriate powder or liquid supplement containing synthetic folic acid.

4.5. Watering

(See paragraph 4.7. of the General section)

4.6. Substrate, litter, bedding and nesting material

(See paragraph 4.6. of the General considerations for non-human primates)

4.7. Cleaning

(See paragraph 4.9. of the General section)

4.8. Handling

Squirrel monkeys can be trained to come forward for titbits or drinks as rewards. They are also capable of learning how to solve tasks for reward. For catching for investigation or treatment, animals should be trained to enter gangways with trap cages or individual enclosures.

4.9. Humane killing

(See paragraph 4.11. of the General section)

4.10. Records

(See paragraph 4.10. of the General considerations for non-human primates)

4.11. Identification

(See paragraph 4.11. of the General considerations for non-human primates)

5. Training of personnel

(See paragraph 5 of the General considerations for non-human primates)

6. Transport

(See paragraph 6 of the General considerations for non-human primates)

d. Additional guidelines for housing and care of macaques and vervets

1. Introduction

The three species of macaque which are most commonly kept for research purposes, all originate from Asia: *Macaca mulatta* (the rhesus monkey), *Macaca fascicularis* (the long-tailed, crab-eating or cynomolgus macaque) and *Macaca arctoides* (the stump-tailed or bear macaque). The vervet (*Cercopithecus aethiops* or *Chlorocebus aethiops*) is a rather similar type of African monkey sometimes kept in laboratories. In the wild, all of these species live in matriarchal multi-male/multifemale groups. There are both male and female dominance hierarchies and females form kinship groups within the troop. Social bonds are strongest between related females, and males compete for access to females in oestrus. Two species, the rhesus monkey and stump-tailed macaque live in warm to temperate climates, while the long-tailed macaque is an exclusively tropical species which particularly favours mangrove swamps and often forages in water. The long-tailed macaque is the most arboreal of the four species and the stump-tailed macaque the most terrestrial. The vervet has a wide range of African habitats, including open grasslands, forests and mountains, with climatic conditions ranging from warm temperate to tropical. Rhesus monkeys are seasonal breeders while the other species breed all year round in captivity. All the species have a predominantly vegetarian diet, although they may also feed on insects. Macaques and vervets in captivity have been known to live for more than thirty years.

2. The environment and its control

2.1. Ventilation

(See paragraph 2.1. of the General section)

2.2. Temperature

Rhesus and stump-tailed macaques are tolerant of temperate climates, vervets are also adaptable and temperatures of 16°C to 25°C are suitable. For the long

tailed macaque, however, a more suitable range is 21°C to 28°C, although it will venture outdoors in much cooler weather.

2.3. Humidity

(See paragraph 2.3. of the General considerations for non-human primates)

2.4. Lighting

(See paragraph 2.4. of the General considerations for non-human primates)

2.5. Noise

(See paragraph 2.5. of the General considerations for non-human primates)

2.6. Alarm systems

(See paragraph 2.6. in the General considerations for non-human primates)

3. Health

Old World monkeys belong to the most susceptible species for tuberculosis and a high percentage of Asiatic macaques in the wild are silent carriers of Herpes B (syn. Herpes simiae, Cercopithicine herpesvirus 1). Vervets may also be susceptible to Marburg Virus and Ebola Virus.

4. Housing, enrichment and care

4.1. Housing

Macaques and vervets should be kept with social companions. Should larger groupings be feasible, this should be encouraged. Same-sex groups are most easily created at the time when the animals are separated from their mothers. With all social housing, staff should be vigilant to ensure that aggression is minimised. Vervet colonies are particularly prone to outbreaks of violence, especially after any form of disturbance to the group.

Breeding groups in captivity will usually be composed of one male and six to twelve females. With larger groups, to improve conception rates, two males can

be included. If one male is considerably younger than the other, competition between them will be reduced. Where linked enclosures are used, care should be taken to monitor female-female aggression when the male is out of sight in the other part of the enclosure.

The age of removal of young macaques from their mothers is an important consideration for the breeding female, future breeders and stock animals. The young should not normally be separated from their mothers earlier than 8 months of age, preferably 12 months, apart from infants which are unable to be reared by their mother, for example due to poor lactation, injury or illness. To avoid major behavioural disturbances, such hand-reared animals should be re-integrated with other compatible animals as soon as possible. Separation before six months can cause distress and may lead to persistent behavioural and physiological abnormalities.

Multiple feeding and watering stations are required in pens to prevent undue competition.

Provision should be made for capturing animals when required for veterinary or husbandry reasons.

4.2. Enrichment

These animals, having advanced cognitive capabilities, require a suitably complex environment. A solid floor, which can be enriched by providing a non-toxic substrate, will allow for the concealment of scattered food items and encourage foraging. The enclosures should include vertical and diagonal structures for climbing, facilitating the use of the whole volume of the enclosure. Shelves and perches should not be placed one above the other. A space should be left between the shelf and enclosure wall to allow for the animal to suspend its tail freely.

Ladders, perches and toys to chew are all of value. In larger enclosures, a water tank (which is easily emptied) is particularly valuable for *M. fascicularis* but *M. mulatta* will also use it. Food can be dropped into the water for the long-tailed

macaque and it will dive to retrieve it. Devices to encourage foraging (ranging from food scattered in the substrate to puzzle-feeders) have proved effective. Suitable food material can be placed on the mesh roof to encourage the animals to access it from the top of the enclosure. As novelty is important, toys should be provided and exchanged frequently.

4.3. Enclosures – dimensions and flooring

For the animals to feel secure, the design and interior dimensions of the enclosure should at least allow them to climb above human eye level.

Housing the animals in groups and in enclosures larger than the minimum group sizes and enclosure dimensions proposed in table F.3 should be encouraged

Table F.3. Macaques and vervets: Minimum enclosure dimensions and space allowances*

	Minimum enclosure size (m^2)	Minimum enclosure volume (m^3)	Minimum volume per animal (m^3)	Minimum enclosure height (m)
Animals less than 3 yrs of age **	2.0	3.6	1.0	1.8
Animals from 3 yrs of age ***	2.0	3.6	1.8	1.8
Animals held for breeding purposes****			3.5	2.0

* Animals should only be kept singly under exceptional circumstances (see paragraph 4.1).
** An enclosure of minimum dimensions may hold up to three animals
*** An enclosure of minimum dimensions may hold up to two animals
**** In breeding colonies no additional space/volume allowance is required for young animals up to 2 years of age housed with their mother.

Animals should be housed in indoor enclosures providing appropriate environmental conditions of sufficient size to permit all animals to be provided with at least the minimum space allowances set out in table F.3 above.

In certain climates, it may be possible to hold breeding and stock animals in entirely outdoor enclosures if adequate shelter from climatic extremes is provided.

As these animals spend considerable periods on the ground, the use of solid floored pens is recommended. Where grid floors are used, the animals must have access to a suitable solid resting and foraging area.

4.4. Feeding

(See paragraph 4.4. in the General considerations for non-human primates)

4.5 Watering

(See paragraph 4.7. of the General section)

4.6. Substrate, litter, bedding and nesting material

(See paragraphs 4.3. and 4.6. of the General considerations for non-human primates)

4.7. Cleaning

(See paragraph 4.9. of the General section)

4.8. Handling

Macaques can easily be trained to co-operate in simple routine procedures such as injections or blood sampling and to come to an accessible part of the enclosure.

4.9. Humane killing

(See paragraph 4.11. of the General section)

4.10. Records

(See paragraph 4.10. of the General considerations for non-human primates)

4.11. Identification

(See paragraph 4.11. of the General considerations for non-human primates)

5. Training of personnel

(See paragraph 5 of the General considerations for non-human primates)

6. Transport

(See paragraph 6 of the General considerations for non-human primates)

e. Additional guidelines for housing and care of baboons

1. Introduction

Baboons include three genera, Papio, Theropithecus and Mandrillus, in which the commonly used species are *Papio papio* (Guinea baboon) and *Papio anubis* (Olive baboon).

Baboons inhabit woodlands and savannahs, including arid steppes and mountain deserts. They are heavily built terrestrial and quadrupedal animals. They display a great prognathism. Males are equipped with large canines.

Baboons are omnivorous and eat a wide variety of foods, mostly vegetarian (fruit and roots), although they do eat insects and occasionally mammal prey such as young gazelles or other nonhuman primates.

Papio papio and *Papio anubis* live in multi-male/multi-female groups.

Baboons in captivity have been known to live for more than thirty-five years.

The following guidelines are relevant to *Papio papio* and *Papio anubis*.

2. The environment and its control

2.1. Ventilation

(See paragraph 2.1. of the General section)

2.2. Temperature

Baboons are tolerant and adaptable of temperate climates and temperatures of 16°C to 28°C are suitable.

2.3. Humidity

(See paragraph 2.3. of the General considerations for non-human primates)

2.4. Lighting

(See paragraph 2.4. of the General considerations for non-human primates)

2.5. Noise

(See paragraph 2.5. of the General considerations for non-human primates)

2.6. Alarm system

(See paragraph 2.6. of the General considerations for non-human primates)

3. Health

(See paragraph 3 of the General considerations for non-human primates)

4. Housing, enrichment and care

4.1. Housing

Adults and juveniles should be kept with social companions. Stock animals can be kept in compatible same-sex groups. Wherever possible, experimental animals should be kept in same-sex pairs or groups.

Breeding groups should be composed of one male and six to seven females, or two males and twelve to fifteen females. Larger groups may be much more difficult to manage. Staff should be vigilant to ensure that aggression is minimised. Baboon colonies are particularly prone to outbreaks of aggression, especially after any form of disturbance to the group.

The young should not normally be separated from their mothers before eight months of age, preferably twelve months, apart from infants which have been rejected or whose mother is not lactating adequately, or other veterinary reasons.

4.2. Enrichment

Baboons, having advanced cognitive capabilities, require a suitably complex environment. A solid floor, which can be enriched by providing a non-toxic substrate, will allow for the concealment of scattered food items and encourage foraging. Ladders, perches and toys to chew are all of value. Food may be

placed on the mesh roof to encourage the animals to access it from the top of the enclosure. Due to the size and the behavioural needs of baboons, enclosures should be robust and include broad shelves and blocks. As novelty is important, toys should be provided and exchanged frequently.

4.3. Enclosures – dimensions and flooring:

For the animals to feel secure, the design and interior dimension of the enclosure should be at least high enough to allow them to climb above human eye level

Housing the animals in groups and in enclosures larger than the minimum group sizes and enclosures dimensions proposed in table F.4 should be encouraged

Table F.4. Baboons: Minimum enclosure dimensions and space allowances*

	Minimum enclosure size (m^2)	Minimum enclosure volume (m^3)	Minimum volume per animal (m^3)	Minimum enclosure height (m)
Animals** less than 4 yrs of age	4.0	7.2	3.0	1.8
Animals** from 4 yrs of age	7.0	12.6	6.0	1.8
Animals held for breeding purposes***			12.0	2.0

* Animals should only be kept singly under exceptional circumstances (see paragraph 4.1.).

** An enclosure of minimum dimensions may hold up to 2 animals.

*** In breeding colonies no additional space/volume allowance is required for young animals up to 2 years of age housed with their mother.

Animals should be housed in indoor enclosures providing appropriate environmental conditions of sufficient size to permit all animals to be provided with at least the minimum space allowances set out in table F.4.above.

In certain climates, it may be possible to hold breeding and stock animals in entirely outdoor enclosures if adequate shelter from climatic extremes is provided.

Enclosures should have a solid floor.

4.4. Feeding

(See paragraph 4.4. of the General considerations for non-human primates)

4.5. Watering

(See paragraph 4.7. of the General section)

4.6. Substrate, litter, bedding and nesting material

(See paragraphs 4.3. and 4.6. of the General considerations for non-human primates)

4.7. Cleaning

(See paragraph 4.9. of the General section)

4.8. Handling

Baboons can be easily trained to co-operate in simple routine procedures such as injections or blood sampling and to come to an accessible part of the enclosure. However, for personnel safety considerations, great care should be taken in handling adult animals and suitable restraint deployed.

4.9. Humane killing

(See paragraph 4.11. of the General section)

4.10. Records

(See paragraph 4.10. of the General considerations for non-human primates)

4.11. Identification

(See paragraph 4.11. of the General considerations for non-human primates)

5. Training of personnel

(See paragraph 5 of the General considerations for non-human primates)

6. Transport

(See paragraph 6 of the General considerations for non-human primates)