

Designing Environments for Aged Primates

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Introduction

When designing a captive environment, the age of the animals concerned should be a primary consideration as the requirements of captive primates vary across their lifespans. Primates have long natural lifespans, which are often extended by life in captivity. Many monkey species in captivity (e.g., macaques, capuchins) can have lifespans well over 30 years, while great apes (e.g., chimpanzees, gorillas) can live over 50 years. With old age comes disease and incapacity similar to that experienced by geriatric humans, such as osteoporosis, arthritis, cataracts, endocrinological disorders, as well as degeneration of cognitive abilities (Uno 1997). Such age-related conditions will affect the way in which aged individuals are able to respond to and utilize their environments.

Captive environments can also contribute to or exacerbate age-related conditions. For example, osteoarthritis in New World monkeys is primarily limited to captive individuals (Rothschild & Woods 1993). Restrictive caging has been reported to impair joint mobility, however this may be ameliorated by improving the quality of the environment (Turnquist 1985). Many aged primates also become obese, which can result in more serious disorders such as diabetes (Wolfensohn & Honess 2005). Environments which are not designed to meet the needs of aged animals can lead to a further deterioration in health, which will lead to poor welfare. As such, it is necessary to plan for an environment that will allow animals to remain active to help stave off such conditions. Additionally, social and thermoregulatory needs may also change with age, and should be taken into consideration.

Many facilities keeping primates, including zoos and research facilities, will have aged individuals in their care. This may be particularly relevant to sanctuaries caring for primates retired from laboratories, as those who are retired are frequently aged animals. There is a need for greater consideration of age as a factor in enclosure design and the purpose here is to list considerations and requirements for ageing primates. Through making changes to enclosures to accommodate the needs of ageing primates, this can lead to major improvements in their use of the enclosure and to their behavior (e.g., Zucker et al., 1991), as well as prevention of physical deterioration related to increased inactivity.

Factors to Consider

Accessibility

Age-related conditions, such as arthritis, can hinder animals' ability to move about their enclosures. For example, climbing or jumping onto high perches and swings or leaping between gaps may become impossible. In particular, this is likely to apply to individuals who have been kept in restricted physical environments (e.g., many ex-laboratory and ex-pet primates). As well, reductions in visual capabilities may further reduce the animals' ability to confidently negotiate the environment. Reduced mobility should never be used as a reason to restrict the environment of older animals. Rather, geriatric individuals require environments designed to encourage movement and flexibility in order to delay physical deterioration and to maintain good welfare. Therefore, it is necessary to consider:

- Use of fixed substrates. Sturdy climbing materials should be used for geriatric primates. Adults prefer fixed, and avoid flexible, substrates for locomotion and perching (e.g. squirrel monkeys: Taylor & Owen 2003, Williams et al. 1988; macaques: Kopecky & Reinhardt 1991, chimpanzees: Howell et al. 1997), which is likely to be especially important to older animals who move with difficulty. Therefore moving substrates such as ropes and flexible walkways should be replaced by fixed and stable materials.

- Positioning of climbing structures. Rather than providing vertical climbing structures, some older animals may prefer these to be at an angle, creating a ramp or steps to allow for access. Figure 1 shows steps were created to allow a group of aged long-tailed macaques (20 yrs and over) access to a second level of their enclosure, which they use with great frequency. The width of the steps and the spacing between them was carefully designed to provide ease of access.
- The distance of gaps. Depending on the physical condition of the animals, it may be necessary to consider making stable bridges between substrates.
- Provision of substrates which allow access to higher levels. Evidence from a variety of species indicates that primates show strongly prefer elevated points in their enclosures (tamarins and marmosets: Buchanan-Smith 1991, Buchanan-Smith et al. 2002; macaques: Clarence et al. 2006, Waitt et al. 2008; chimpanzees: Ross & Lukasb 2006). Aged animals also exhibit these preferences when they are able to access higher levels (Taylor & Owen 2003, Zucker et al 1991), and they should be given opportunity to do so. Older animals should not be forced to climb up fencing to reach upper parts of caging, as this may be difficult and painful. Branches, steps or other climbing structures, can be placed as ramps to allow access to higher perching.

Furnishings

In addition to accessibility, it is necessary to consider the types and design of furnishings. One should take into account:

- Width. Aged individuals will often require wider perches and climbing structures to move confidently as well as for sitting and sleeping comfortably (Figure 2). However one must keep in mind the shape of the shelving, as New World monkeys will require rounded, rather than flat perching to prevent pressure sores, as they lack the ischial callosities of Old World monkeys (Abee 1985).
- Materials. Wood is preferable to use as perches for primates, as it has qualities which are more appealing over other materials, such as its thermo-neutral properties. This may be especially important to older animals (see below)
- Providing comfortable sleeping sites. Extra bedding material for those primates that build nests (e.g., apes, some Strepsirrhines) to provide comfort and warmth.
- Visual barriers. The quality and quantity of social interactions can change with age, and this can vary with sex and species. For example, older females of various species of macaques opt to engage less in social interactions, (Hauser & Tyrrell 1984; Nakamichi 1984; Veenema et al. 1997), while males may become more social (Corr 2000). In captive chimpanzees, levels of social interaction do not change, though females become more submissive (Baker 2000). As with younger animals captive environments should provide older individuals with the ability to engage or withdraw from social activity as they desire. The provision of visual barriers will allow animals to visually separate themselves from conspecifics as they choose to do so. Visual barriers can also reduce aggression. Although levels of aggression decrease with age (e.g., Baker 2000), aged animals can still engage in highly aggressive behavior with serious consequences (Line et al. 1990). Therefore, the same precautions must be made to reduce potential aggression in groups containing geriatric animals

Thermoregulation

Providing animals with the ability to make behavioral adjustments to help them thermoregulate is particularly important to older animals. Like aged humans, aged nonhuman primates may be particularly sensitive to environmental conditions as they can experience deficits in their autonomic thermoregulatory abilities. This can be due to a variety of age related conditions, including endocrinological dysfunction (Aujard et al 2006). The following considerations should be made:

- Heating. Preferred ambient temperature can vary with age, with aged animals prefer warmer temperatures (e.g., Aujard et al 2006). Providing perching near heat lamps, and plenty of seating areas in sunny locations is important to prevent animals from feeling cold.

- Enclosure materials. Temperature should be considered when selecting these, for example wood, plastic, and fibre have the advantage of being non-thermoconductive, therefore will provide more comfort (Wolfensohn & Honess 2005)
- Floor coverings. Though the use of flooring materials such as wood shavings, bark, straw or hay is always recommended, this is especially important for older animals, as they may be especially sensitive to a cold floor.

Conclusions

With increasing interest both in the retirement of primates from laboratories (Kerwin 2006; Prescott 2006; Seelig & Truitt 1999) and in the study of age-related and degenerative models, there is likely to be an increased need to accommodate aged non-human primates. In order to prevent physical and psychological deterioration in older animals, it is important to apply the same principles of environmental enrichment and housing provision as are applied to younger animals. As discussed above, the needs of aged individuals can be highly specific and may be markedly different from those of younger animals of the same species. Therefore we have listed some of the key aspects of environmental and housing provision that those accommodating older primates should consider to preserve the health and well-being of the animals in their care.

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Figure 1. Steps designed to allow geriatric macaques access to upper level of their enclosure



Figure 2. Wide stable perches provides comfortable seating for older macaques.