

Social housing of non-human primates in a research facility: socialisation across macaque species and sexes

A Rehrig*, L DiVincenti Jr and LA Schery

University of Rochester, 601 Elmwood Ave, Box 674, Rochester, NY 14642, USA

* Contact for correspondence and requests for reprints: angelika_rehrig@urmc.rochester.edu

Abstract

Refinement of social housing practices is paramount to improving animal welfare in laboratory environments, especially with regard to non-human primates. Even though social housing of the same species should be considered the optimal paradigm, cynomolgus (*Macaca fascicularis*) and rhesus macaques (*Macaca mulatta*) share similar communication styles making inter-species, opposite sex socialisation a viable approach to providing social enrichment. This paper describes social housing a male cynomolgus macaque, which underwent a routine orchietomy prior to pairing, with a female rhesus macaque for the purpose of providing social interaction for animals that otherwise would have been single housed. Once paired, the primates exhibited behaviours indicative of compatibility, including mounting, lip smacking, grooming, co-threatening and choosing to remain in close proximity. Social housing also ameliorated abnormal behaviour (eg pacing, self-directed fur-plucking) in the female macaque. Neutering male macaques, mixed-species pairing and opposite sex socialisation are all valid options for reducing the number of individually housed primates in research facilities.

Keywords: animal welfare, cynomolgus macaque, interspecies, opposite sex, rhesus macaque, social housing

Introduction

The eighth edition of *The Guide for the Care and Use of Laboratory Animals* (2011) emphasises the importance of social housing for social species, especially with regard to non-human primates. This refinement is strengthened through the position statement set forth by the Association for the Assessment and Accreditation of Laboratory Animal Care (AAALAC) (2011) which deems social housing as ‘the default’ practice. The Institute for Laboratory Animal Research (ILAR) recognises the benefits of social housing using parameters identified to indicate psychological well-being in non-human primates (NHPs), including coping with routine and unfamiliar events, the presence of appropriate species-typical behaviours, the absence of abnormal behaviour, and a balanced temperament with no chronic behavioural indicators of stress (National Research Council 1998).

Social housing of NHPs in laboratory environments is often accomplished through iso-sexual, conspecific pair housing and has been shown to improve well-being in both male and female primates (Baker *et al* 2012). However, this social housing method can become complicated in smaller facilities where any given experimental protocol may contain a limited number of primates, often of different sexes and species. These circumstances require an open-minded approach where all stakeholders, including the veterinary and behavioural staff, the principal investigators, and University of Rochester’s Institutional Animal Care and

Use Committee (IACUC) work together to create innovative techniques to provide social housing opportunities. Some of these techniques, such as pairing across macaque species (DiVincenti *et al* 2012) and pairing vasectomised males with females (Weed *et al* 2003), have been described and are successful. Both of these techniques offer unique methods to implement social housing for primates that may otherwise have remained single-housed, a condition known to increase the occurrence of maladaptive behaviour in primates (Bayne *et al* 1992). Though separation of different species is the standard practice in research facilities, species that are behaviourally compatible and have similar pathogen status can be co-housed (National Research Council 2011). However, to date, social housing of mixed gender pairs of different species has not been described in the literature.

Our facility houses both cynomolgus (*Macaca fascicularis*) and rhesus macaques (*Macaca mulatta*) in relatively small numbers with few individuals assigned to each protocol. Previously, we had iso-sexually, pair-housed both male and female rhesus and cynomolgus macaques when conspecific pair housing was not possible (DiVincenti *et al* 2012). However, due to the need for surgical manipulation to prevent pregnancy, male-female pairs had not been previously considered. This paper describes pair housing a male cynomolgus macaque with a female rhesus macaque for the purpose of providing social interaction for animals that otherwise would have been single-housed.

Figure 1



Female rhesus macaque (*Macaca mulatta*) rests in close contact with her new cage mate, a neutered male cynomolgus macaque (*Macaca fascicularis*).

Materials and methods

A male cynomolgus macaque (4.4 years old; 6 kg) and a female rhesus macaque (6.7 years old; 5.9 kg) were acquired from a commercial vendor (Primate Products Inc, Miami, FL, USA). The subjects were housed in an NIH-assured, AAALAC-accredited institution, and all procedures were approved by the IACUC. The male macaque underwent a routine orchietomy performed by veterinary staff under general anaesthesia and received standard analgesics following surgery. Contraception in the male was elected to avoid the repeated injections and potential side-effects of injectable contraceptives and the relatively more invasive surgical sterilisation procedure in the female. After consultation with the investigator, orchietomy was elected over vasectomy as the resulting behavioural and conformational changes resulting from orchietomy were actually desired. The primates were housed in a custom-built, stainless steel cage (quad) with vertical access measuring $81.3 \times 73.7 \times 200$ cm (length \times width \times height) (Primate Enrichment Unit, Lab Products, Seaford, DE, USA). Both primates had *ad libitum* access to food and water and were on a 12:12 h light:dark cycle. Environmental enrichment was provided to both primates daily including manipulanda, puzzle feeders and fresh produce.

The subjects were single-housed in a quad cage with visual access through grate partitions for one month prior to full contact introduction. During this phase of the introduction, animal care and behavioural staff conducted 10-min, daily observations using *ad libitum*

sampling to assess compatibility. Throughout this period, and the subsequent full contact introduction, the presence of affiliative behaviours (eg lip smacking, sitting together in close proximity), aggressive behaviours (eg lunging, open-mouth threat) and abnormal behaviours (eg pacing, self-directed fur plucking) were recorded for both primates. On the day of the full contact introduction, both the upper and lower grate partitions were opened to allow access to the entire quad. Behaviour staff recorded interactions using *ad libitum* sampling for 1 h, twice daily (morning and afternoon) for three days following introduction. Additionally, on the first day of introduction, the primates were videotaped to assess compatibility when observers were not present. In light of initial observations and review of the video on day one, the decision was made to keep the primates pair-housed and not separate them overnight. Following the first three days of monitoring, compatibility continued to be assessed through 10-min, daily sessions for one week and then weekly for two months. At present, the primates have continued to have full access to one another with no signs of incompatibility for ten months.

Results

In protected contact, both macaques showed interest in one another, often sitting at the grate watching each other calmly. No aggressive interactions, such as lunging at the grate, were observed. Once moved to full contact, the primates showed affiliative behaviours (eg lip smacking, grooming) with no aggressive interactions. Initially, long bouts of mounting and allo-grooming occurred, especially from the male towards the female. Co-threatening of unfamiliar people and other primates in the room was also documented on the first day. Mounting continued into the second day, but at a decreased frequency and was not observed with regularity after day three. Grooming and resting together in close contact was seen throughout the monitoring period (Figure 1). With the move to full contact, a significant shift in behaviour was noted in the female rhesus macaque. During the protected contact phase, she frequently engaged in pacing and vocalising during observations. She also displayed moderate apprehension toward human interaction and novel treat or enrichment items, often retreating to the back of the cage. Furthermore, the female presented with mild alopecia on her forearms and legs from self-directed fur plucking. On the first day of social housing, the pacing stopped altogether. Instead of retreating or pacing, she would move closer to the male and position herself behind him. After one week of social housing, she became more receptive to human interaction (ie would approach and accept treats) and showed curiosity towards novel objects (ie additional weekly enrichment including paper bags, cardboard tubes, pine cones etc). At two months, the female's fur condition improved to the extent that no alopecia could be detected, but the male presented with mild alopecia on his shoulders.

Discussion

This case demonstrates that cynomolgus and rhesus macaques of opposite genders can be successfully pair-housed in research facilities. The male cynomolgus macaque showed no ill effects from the sterilisation procedure and engaged in mounting when given access to the female. Though the surgery did present an experimental variable, the research was consistent with sterilisation. In addition, both primates exhibited affiliative behaviours indicative of compatibility. These results suggest that cynomolgus and rhesus macaques share similar communication styles making this method of social housing a novel, yet viable approach to providing social enrichment (DiVincenti *et al* 2012).

Though both primates showed an increase in psychological well-being through the expression of species-appropriate behaviour, the effect was most significant in the female rhesus which had exhibited moderate levels of abnormal behaviour. Immediately after being social housed, the pacing behaviour subsided highlighting the beneficial 'buffering effect' of a companion reported in many primate species, especially during stressful or novel situations (Olsson & Westlund 2007). Though the female's self-directed fur plucking also appeared to be managed the appearance of alopecia on the male warranted investigation. Through casual observations and video monitoring it was determined that the female shifted from self-directed fur plucking to over-grooming the male. Since his alopecia was mild in nature, the pair were kept together since the benefits of social housing far outweighed the cost of minor fur loss.

Increased species-appropriate behaviour and a reduction in abnormal behaviour makes social housing the key enrichment practice for all primate management programmes. In conclusion, neutering male macaques, mixed-species pairing and opposite sex socialisation are all valid options

for increasing the number of socially housed primates kept in laboratory environments. However, laboratories should continue to explore and report these novel social-housing paradigms in the interest of promoting psychological well-being in laboratory-housed primates.

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