

Supplementary resources for members of local ethical review processes

Rats: Good practice for housing and care



Research Animals Department, RSPCA
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Before using these guidance notes, please read the introductory sheet that accompanies this series:
Supplementary resources for lay members: an introduction

Natural history

Laboratory rats are descended from the Brown or Norway rat, *Rattus norvegicus*, which originates from wetland habitats in central Asia. Brown rats are highly adaptable and intelligent omnivores, which has enabled the species to disperse worldwide and inhabit a wide variety of climates and habitats. They live in and around human settlements, in buildings, harvest stores, sewers and rubbish dumps, but prefer to live in an underground system of burrows, usually near water. The size of the home range in the wild is around 100 m². They are nocturnal and have three activity periods at the beginning, middle and end of the dark phase.

Rats are extremely sociable - generally, a dominant male lives with a number of females and subordinate males, but group size can vary. When groups become very large, they split into smaller sub-groups that are often family groups. Play is very important to them for social development and bonding, and they have the most complex play behaviour of all rodents.

The senses of smell, hearing and touch are highly developed. Smell is believed to be the most important sense and is used to identify other rats and ascertain their age, rank, sexual status, kin relationships and what they have been eating! They can hear ultrasound and communicate extensively with one another using a large repertoire of ultrasonic squeaks. These are inaudible to humans, but can be heard using a bat detector and work is ongoing to try to interpret them. Rats can also see ultraviolet light.

Many complex, natural behaviours observed in wild rats are retained in laboratory rats and are expressed as soon as the animals have the opportunity (see www.ratlife.org for an excellent illustration of this). A large number of behavioural studies have shown that a complex environment will benefit rats - and can be achieved for rats in all types of establishment.

What rats need

The following list of requirements has been defined on the basis of published animal welfare studies that have evaluated rats' preferences and motivation for resources. Different strains may differ in their exact preferences (for nesting material types or shelter design, for example), but all rats have the same basic needs as set out below. More information on rat welfare, housing and care can be found in the references listed at the end of this document.

- **Social housing**

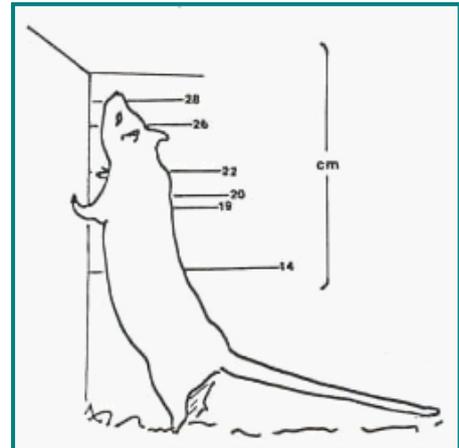
Rats are highly social and should never be housed singly without veterinary, welfare or *compelling* scientific justification. Housing rats in groups of up to 5 individuals of the same sex usually works well. Groups should be kept stable with no removal or addition of rats after they are formed wherever possible. Providing an enriched environment in a sufficiently large cage will reduce the risk of social stress and aggression. Any requirement for housing animals individually should be critically reviewed and, where this is unavoidable, each rat should be able to see, hear and smell other rats in adjacent cages.



- **Plenty of space and height**

Cages need to provide enough space for enrichment, and to permit a range of behaviours, including exercise, foraging, appropriate social behaviour and play. The space allowances set out in regulatory guidelines, such as the UK Home Office Codes of Practice, are minimum standards and rats have been shown to prefer cages significantly larger than the 'standard' sizes, so it is important to use the largest cages possible with a stocking density that allows each animal plenty of space.

Rats rear on their hind legs when exploring and playing, so they should be able to rear up in at least part of the cage. As a guide, this will require an area with a height of around 18 cm for juveniles up to 150g, 22 cm for rats up to 450g and 30 cm for large, adult males.



Rats have also been successfully group housed in large enriched pens, or given periods of access to exercise areas. Both options should be given serious consideration.

- **Solid floor with appropriate litter material**

Rats demonstrate a very strong preference for solid floors, as opposed to grid floors - they will lift doors weighing up to 83 % of their body weight in order to leave a cage with a grid floor and enter one with a solid floor. Solid floors with litter, to a minimum depth of 2 cm, are more comfortable than grid floors and allow foraging and digging. Rats express a preference for wood-based litter with large particles (*i.e.* wood shavings rather than sawdust). Aspen substrate should not be used, as it has been shown to adversely affect their respiration.

If there is a genuine scientific justification for housing rats on grid floors, a solid area should always be provided for resting. This could be a refuge with a solid floor. Note, rats are sometimes housed on grid floors in the belief that this will prevent them from eating their faeces (coprophagy). However, rats ingest their faeces directly from the anus so this is not a valid reason and should be challenged.





- **Refuges and/or tunnels**

Refuges are absolutely critical for rodent welfare and should always be provided for rats, especially females with litters. They help to make the animals feel secure and fulfil their preference to remain in contact with a solid surface (thigmotaxis); they also encourage climbing and make the rats more confident and less wary of new objects or situations (neophobic). Opaque materials such as metal or opaque plastic are preferred by rats; clear plastic tinted red or yellow can be used if easier observation of animals is necessary.

- **Something to gnaw**

The incisor teeth of rats grow continually and are ground down in the wild when hard or gritty food is consumed. Wooden blocks or sticks should be supplied in the laboratory to perform this function.

- **Opportunities to forage**

Foraging for part of the food ration or additional treats in the litter will facilitate natural behaviour such as storing (caching) food, besides helping to prevent obesity and loss of condition by encouraging activity. Suitable foraging foods include sunflower seeds, standard rat diet or commercially available forage mixes.

- **Appropriate light levels and regimes**

The light-detecting cells in rats' eyes are adapted to work in very low light levels between 1 and 40 lux. Lighting should be below 60 lux for pigmented strains and 25 lux for albino strains. This can be achieved by selecting appropriate lighting systems (with a UV component where possible) and/or fitting shading above cage racks. Wherever feasible, lighting regimes should be set so that the rats' active period is during the human working day. This makes it easier to monitor their wellbeing and may also reduce stress caused by husbandry and experimental procedures.

- **Acceptable levels of ultrasound**

There are a number of sources of ultrasound in the laboratory, such as running water and electronic equipment including oscilloscopes and monitors. Ultrasound is part of the natural environment for rats and does not necessarily cause problems, but it is good practice to check each room with a bat detector to ensure that electrical equipment is not creating excessive levels of ultrasound, which could cause distress. A recent study also suggests that rats prefer silence to a radio playing, so it would be good practice to research this further and review radio use – see reference [11].

- **Cleaning protocols that take account of rat senses and behaviour**

Cage cleaning can be stressful for rodents, as it destroys all of their scent markings. Research is ongoing into the effects of cage cleaning on rodent welfare, and what optimal cleaning protocols might be. Current understanding is that cage cleaning does not appear to be a major stressor for *non-breeding rats housed in stable groups*, so these animals should be cleaned as often as is necessary to maintain a healthy environment and prevent levels of ammonia and micro-organisms from becoming harmful or unpleasant.

However, *breeding rats* should not have their cages cleaned during the final third of pregnancy or the first three days following birth. Cannibalism in breeding rats is especially likely if pups are under two days old at first cleaning. For further information on cage cleaning, see reference [1].

- **Good handling by familiar staff**

Rats recognise humans as individuals so it is always best if they are handled by a person familiar to them - a good relationship with a handler makes an important contribution to the welfare of these animals.



Potential husbandry related welfare problems and how to resolve them

Abnormal behaviours that may be observed in the rat include anxiety, panic attacks, fur-chewing, lethargy or depression. Stereotypies such as pacing or route-tracing indicate that an animal's environment is, or has been, inappropriate and that the animal is unable to cope. A good quality enriched environment will help to reduce the risk of abnormal behaviours developing; if they do occur there should be an immediate review of housing and care that addresses all of the topics in this document.

Obesity and loss of condition, for example a dull, rough coat, can be problems in long term studies. They are less frequently observed in pen-housed rats. Time-based feeding restriction is commonly used to counter the problem but this can lead to boredom, frustration and aggression so it is good practice to explore other options. These include increasing foraging or other activities, or reducing the size of food hopper apertures.

Leg and foot problems can also occur in the long term, if animals are obese, dropped in the cage following dosing, or housed on grid floors. They can be prevented by preventing obesity, housing on solid floors and ensuring that staff are trained to replace rats gently after dosing.



Rat housing and care: ERP aide-memoire

- ❖ **Social housing in stable same sex groups**
- ❖ **Plenty of space to include enrichment and allow a variety of normal behaviours**
- ❖ **Enough height for rats to be able to rear up in at least part of their cage**
- ❖ **Solid flooring with wood-based litter to a minimum depth of 2cm**
- ❖ **Refuges and/or tunnels (preferably made from opaque materials)**
- ❖ **Something to gnaw (e.g. wooden blocks, sticks)**
- ❖ **Opportunities to forage in litter for part of the food ration or treats**
- ❖ **Appropriate light levels (below 60 lux for pigmented strains and 25 lux for albino strains) and regimes (so that the rats active period is during the human working day)**
- ❖ **Acceptable levels of ultrasound**
- ❖ **Empathetic cage cleaning protocols, especially for breeding animals**
- ❖ **Good handling by familiar staff**

Notes



Recommended references

1. RSPCA (2011) *Cage cleaning mice and rats*. Download at www.rspca.org.uk/sciencegroup/researchanimals/ethicalreview/housingandcare
2. Animal Research Review Panel (2007) *Guidelines for the Housing of Rats in Scientific Institutions*. Orange NSW, Australia: Animal Welfare Branch NSW Department of Primary Industries. Download at <http://tinyurl.com/66nzcqt>
3. Berdoy M (2003) *The Laboratory Rat: A Natural History*; see www.ratlife.org (A training video by Manuel Berdoy that monitors a group of laboratory rats following their release into a large outdoor enclosure. It provides valuable insights into rat behaviour and is highly recommended.)
4. FELASA (2007) *Euroguide on the Accommodation and Care of Animals Used for Experimental and Other Scientific Purposes: Based on the Revised Appendix A of the European Convention ETS123*. Available for purchase at www.rsmppress.co.uk/bkfelasa.htm
5. Koolhaas JM (2010) The laboratory rat. Chapter 22 in: *The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals*, 8th edn, pp 311-326. Wiley-Blackwell.
6. Lawlor MM (2002) Comfortable quarters for rats in research institutions. In: *Comfortable Quarters for Laboratory Animals*, 9th edn (V & A Reinhardt eds), pp 26-32. Washington, DC: Animal Welfare Institute, www.awionline.org
NOTE: the 10th edition of *Comfortable Quarters* is under production at the time of writing.
7. NC3Rs (2008) *Rodents*. www.nc3rs.org/informationportal click on "Rodents".
8. Patterson-Kane EG (2004) Enrichment of laboratory caging for rats: a review. *Animal Welfare* 13: S209-214.
9. Reinhardt V and Reinhardt (2010) *A Refinement and Environmental Enrichment for All Laboratory Animals*; see <http://labanimals.awionline.org/SearchResultsSite/refine.aspx> (The Animal Welfare Institute's searchable database).
10. See also the RSPCA/UFAW Rodent Welfare Group meeting reports, which can be downloaded at www.rspca.org.uk/sciencegroup/researchanimals/implementing3rs/rodentwelfaregroup
11. Krohn TC, Salling B and Hansen AK (2011) How do rats respond to playing radio in the animal facility? *Laboratory Animals* 45: 141-144



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RSPCA, Research Animals Department
Wilberforce Way, Southwater, Horsham, West Sussex RH13 9RS
www.rspca.org.uk/researchanimals



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