

# The purpose and use of singly housed animals in scientific research

MARK HARRINGTON and GEORGE ZIMMERMAN

Central Biomedical Service, Imperial College London

Correspondence: [m.harrington@imperial.ac.uk](mailto:m.harrington@imperial.ac.uk)

## Reasons for singly housing animals

There are few reasons why an animal must be housed on its own. Some of the main factors are either behavioural, health or research based.<sup>1,2</sup>

Behavioural as reasons to singly house animals:

- Fighting, mostly caused by territorial aggression or barbering (overgrooming).
- Social issues can also be a cause for single housing due to gender related behaviours and sexual incompatibility.

Health concerns as reasons to singly house animals:

- Animals needing isolation from others due to infectious pathogens.
- Animals needing isolation from others to recover in a more stable environment from situations such as surgery, injury or sickness.

Research purposes as reasons to singly house animals:

- Studies needing animals isolated, to enable the correlation of data with the animal, without interferences from external influences such as other cage mates.

## Strategies for reducing stress in singly housed animals

When using a singly housed system there is the need to compensate for the lack of available social interactions.<sup>1,2</sup> This can be done by providing extra and unique forms of enrichment and modifying the cage housing to better suit the occupants.

Example of alternatives to single housing:

- Improving/rotating the enrichment provided to the animals.
- Providing a social companion animal.
- Allow visual/olfactory contact with the conspecific animals.
- Providing larger cages to encourage more exploratory behaviour.
- Regrouping animals back together when possible.
- Use of cage monitoring camera system.

Cages or pen walls allowing good visual contact (Figure 1) with the surrounding environment and equipped with sheltered area large enough to hold all animals within the group.<sup>3</sup>



**Figure 1.** Good visual contact.

Refined rat housing (Figure 2) which allows the animals to rear and climb.<sup>4</sup>



**Figure 2.** Refined rat housing.

Automated home cage monitoring system (Figure 3) to track individual mice in group housed environments without compromising Animal Welfare.<sup>5</sup>



**Figure 3.** Automated home cage monitoring system.

## Examples of singly housed animals at Imperial College London

Researchers use headplate to monitor brain activity. This is helpful in Alzheimer's disease to study the correlation between sleep and associated phenotypes of the disease with two strategies:

- Monitoring sleep in an animal and recording brain activity.
- Targeting specific cells of brain region known for their involvement in Alzheimer disease and sleep regulation.

Mice are isolated after surgery for two main reasons:

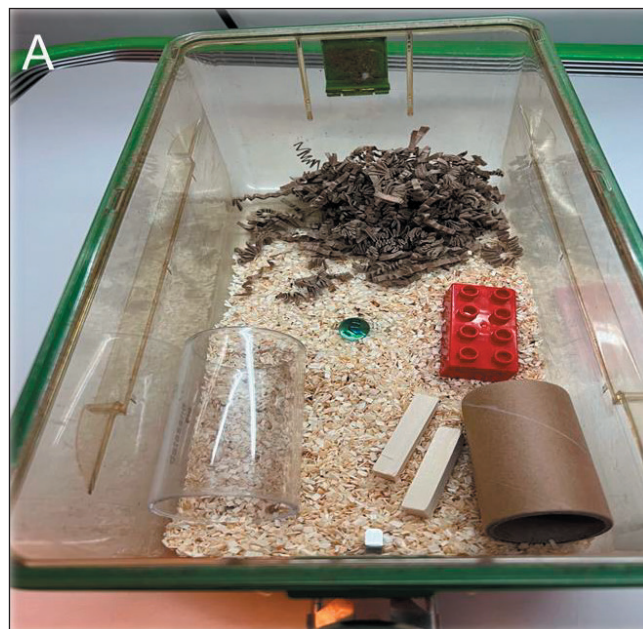
- Safer recovery.
- Sleep behaviour can be affected by the presence of another individual or individuals in the cage.

The animals are provided with extra enrichment and cage modifications to mitigate the effects of single housing.

All our cages have several items for standard enrichment:

- plastic and cardboard tunnels
- tissues (can be shredded or not)
- wooden chew blocks
- wood chip bedding and
- paper strands (used for nesting)
- rodent houses

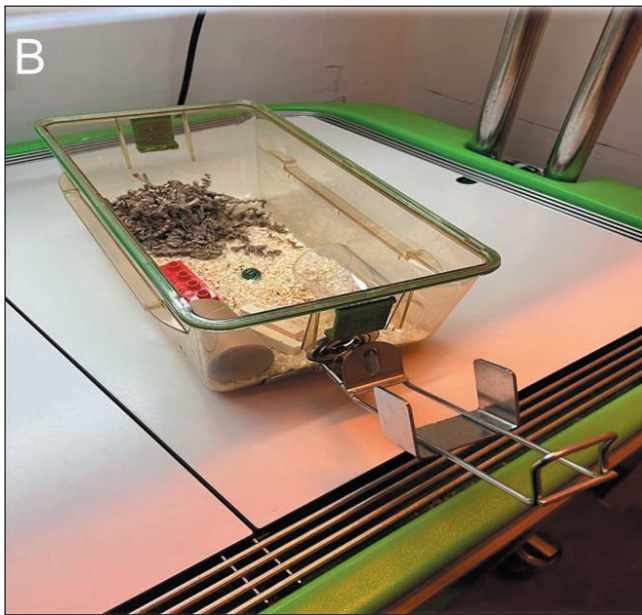
We also try to think of different ways to present enrichment. In singly housed cages, within certain research groups, there are extra forms of enrichment (Figure 4) used like building block pieces and marbles, which help to encourage natural exploration and digging behaviours and are changed regularly to try and avoid boredom and encourage stimulation.



**Figure 4.** Environmental enrichment.

In some of the singly housed caging the bottle holder is placed differently to standard caging. The water bottle inserts into the front to eliminate the possibility of overextending, while drinking and to reduce unnecessary pressure on the head and neck due from the attached headplate (Figure 5) while this is primarily for surgery recovery and for ease of access, as the water bottle is on the outside there is no need for a designated cut out to fit the water bottle in the cage lid, providing more internal space for the animal to feel comfortable and to provide a wider range of enrichment.

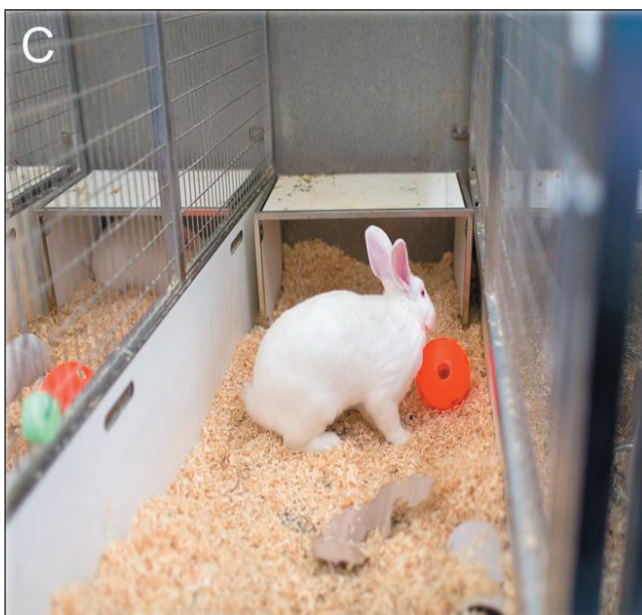
Male rabbits are used for cardiovascular disease research as they have increased chances of contracting the disease.



**Figure 5.** Bottle holder.

Rabbits are territorial, therefore there is the need to put in place a singly housed system to prevent fighting and injury as a consequence of long separation time due to research procedures (e.g. surgery, food control systems).

To minimise the effects of singly housing, the animals are placed in neighbouring pens which are separated with mesh dividers. This allows them to see, smell and partially touch each other, without being able to scratch or bite. (Figure 6)



**Figure 6.** Rabbit pens.

## Our approach to singly housing animals

Single housing advice is embedded within SOPs and good practices. Moreover, when planning experiments with singly housed animals, we always encourage researchers to think:

- How do you feel about singly housed animals in research?
- What other things could you/we take into consideration to mitigate the effects of singly housing?
- What other endeavours do you think could replace singly housing?

## References

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- 4 **Mazhary., H. & Hawkins., P.** (2019). Applying the 3Rs: A Case Study on Evidence and Perceptions Relating to Rat Cage Height in the UK. *Animals*. 9. 1104. 10.3390/ani9121104.
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