



Single housing of mice and recommendations for mitigating measures

Single housing of social species, like mice, for longer periods of time is a welfare concern^{1,2}. According to the **Swiss Animal Welfare Ordinance** (art. 119) single housing of social animals such as mice must be avoided. The single housing of incompatible animals (usually males) is permitted in exceptional cases for a limited period and appropriate documentation is necessary (art. 3, Animal Experimentation Ordinance; art. 113 Animal Welfare Ordinance).

UZH in house regulations: At the UZH single housing must be as short as possible and documented in iRATS. The following information, as requested by the vet office, must be given:

1) Start date of single housing

2) Reason for single housing

- **Acceptable reasons:** Separation necessary because of fighting/incompatibility or approved single housing for experimental reasons.
- **Males:** Latest after 2 months researchers must re-evaluate if single-housed males are still needed. Make sure to keep announced max durations.
- If there is only one single male in a litter, pooling with other males of the same/very similar age (of for example, different genotype if necessary) is recommended by the authorities at the time of weaning.
- **Females:** Must always be housed in groups. Single females (e.g. last female in cage) must be re-grouped with other females and can only be kept singly if needed (and licensed) for experimental purposes, in case health-related issues require single housing or for a short time before delivery.
- Litter with one female offspring: If there is only one single female in a litter, pooling with other females is mandatory (females from different lines can be grouped).

3) Purpose for keeping the animal

- If single males are kept for repeated breeding, then the breeding (dates/time with females) should be documented in iRATS to prove that the animal was not singly over the entire time.
- If animals are re-grouped and need re-labeling for pooling, a one-time re-labeling (also invasive if needed, i.e. ear notch) is allowed.

Detailed information on acceptable reasons, processes and documentation can be found at the [LASC website](#).

Recommended mitigating measures for single housed animals

First of all, avoid single housing if possible. There are several strategies for male mouse routine housing and care that can be applied to keep aggression at a low level: the maintenance of stable groups throughout the experiments, the reduction of stress by implementing [gentle handling techniques](#) like tunnel or cup handling, and the transfer of used but not soiled nest building material during cage change have been reported to reduce aggression significantly^{2, 3, 4, 5}. See also our leaflet on [“Reducing aggression in male mice”](#). While partial cage dividers seem to reduce aggression in male mouse groups⁶, we do not recommend the use of full cage dividers.

Environmental enrichment for single housed mice

The authorities ask about refinement measures in license applications in case single housing is mentioned. **Refinement in the form of environmental enrichment should be applied whenever the experimental purpose allows it.** Single-housed mice may suffer from cold stress; for thermoregulatory reasons, sufficient nest material is therefore essential^{4, 7}.

Other measures can help to occupy animals that are deprived of social interaction. These enrichment measures should be ethological relevant, additional resources that pose neither health nor hygiene risks to animals and experiments (e.g. intake of plastic softeners, damage of implants etc.). **All introduced items must be discussed with the animal facility first to ensure feasibility and hygiene**



rules must be always kept. All changes to standard housing should be accepted by the authorities prior to their implementation.

Examples for suitable enrichment items are: gnawing material, food enrichment, additional shelters (cardboard or plastic; hanging on cage grid or on the cage floor; e.g. loggias, tubes, houses, balconies, a second floor, swings etc.). Running wheels or igloos with running discs on top help to keep the animals physically active. Novelty, for example the rotation of provided objects may serve as cognitive enrichment. If changes in the cage are not possible, also the use of [playpens](#)* has recently been described.

Examples can be found [here](#) and at the [NC3Rs](#) website.

The department of Animal Welfare and 3Rs is happy to help you with designing a suitable housing and handling protocol for your project.

References

- 1) Olsson, I. A. S. & Westlund, K. More than numbers matter: The effect of social factors on behaviour and welfare of laboratory rodents and non-human primates. *Applied Animal Behaviour Science* 103, 229–254.
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- 3) Van Loo PLP, Van Zutphen LFM, Baumans V. Male management: coping with aggression problems in male laboratory mice. *Lab Anim* 2003; 37:300–13.
- 4) Jirkof P, Bratcher N, Medina L, Strasburg D, Ebert P, & Gaskill BN. (2020). The effect of group size, age and handling frequency on inter-male aggression in CD 1 mice. *Scientific reports*, 10(1), 1-13
- 5) Zidar J, Weber EM, Ewaldsson B, et al. Group and Single Housing of Male Mice: Collected Experiences from Research Facilities in Sweden. *Animals (Basel)*. 2019;9(12):1010.
- 6) Tallent, B. R., Law, L. M., Rowe, R. K., & Lifshitz, J. (2018). Partial cage division significantly reduces aggressive behavior in male laboratory mice. *Laboratory animals*, 52(4), 384-393.
- 7) Gaskill, B. N., Gordon, C. J., Pajor, E. A., Lucas, J. R., Davis, J. K., & Garner, J. P. (2013). Impact of nesting material on mouse body temperature and physiology. *Physiology & Behavior*, 110, 87-95.

* The use of playpens might be limited due to spatial or hygiene restrictions at a specific facility