

# Group and single housing of rabbits

A support material from the Swedish 3Rs Center



Photo: The Swedish 3Rs Center

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# Background

This document has been produced by the Swedish 3Rs Center on behalf of the Swedish National Committee for the Protection of Animals Used for Scientific Purposes. The material aims to be a support for those who work with rabbits as laboratory animals in some way. The support material is based on a compilation of scientific literature and information, as well as proven experiences from Swedish laboratory animal facilities that work with rabbits.

Together with the National Committee's group of experts, the 3Rs Center has compiled facts and scientific literature on group and single housing of rabbits. The center has also been in contact with representatives from Swedish organisations that work with rabbits as laboratory animals, to collect their experiences regarding housing rabbits in groups.

In this document you can read about the natural behaviour of rabbits, basic conditions for good rabbit housing, how rabbits can be introduced to and housed in groups, as well as what is important to consider if rabbits need to be housed alone. At the end of this material, the references that have been used in the compilation are listed. Feel free to use the reference list to read more.

## Natural behaviour of rabbits

When keeping rabbits for scientific purposes, it is important to consider the natural behaviours of rabbits. Wild rabbits (*Oryctolagus cuniculus*) live in social groups consisting of 1–8 males and 1–12 females, where males and females have separate social hierarchies. Males defend their territories while females defend their nests, which they often build outside of the group's tunnel system. The territory is marked, by both males and females, with faeces or by rubbing their cheeks against objects throughout the territory. The members of the group can also be marked, probably so that they easily can identify each other. The social hierarchy of males determines the access to females and is maintained through aggressive behaviour towards each other, both within the group and towards rabbits from other groups. The social hierarchy of the females determines access to particularly good nesting sites. Wild rabbits are prey animals and live in complex tunnel systems. In nature, rabbits have the opportunity to run away from each other and it is therefore unusual that serious injuries occur as result of fights in the wild.

While rabbits can defend their resources with aggression, they are also very social, which can be demonstrated through so-called attachment behaviours. Attachment behaviours can be described as social, contact-seeking behaviours exhibited between rabbits within the group. Rabbits can, for example, groom each other's fur and eat or sleep close to each other. Researchers have found that rabbits spend about 70 % of their time resting and grooming each other and themselves. In addition, rabbits spend a large part of their waking hours looking for food.

## **Rabbits as laboratory animals**

The New Zealand White (NZW) is the most commonly used rabbit breed in research. This breed originates from the wild European rabbit (*Oryctolagus cuniculus*). Most of the social behaviours of the wild rabbit still exist in domesticated rabbits, which, like wild rabbits, live in social hierarchies.

Traditionally, rabbits used in research have been housed individually in small cages. One of the reasons has been to avoid aggression that can occur when the rabbits are housed in groups in limited spaces. Being alone in a small area causes stress and frustration in rabbits, which can lead to them developing physiological problems, such as increased heart rate and an increased immune response. It can also disrupt the development of the brain and lead to abnormal behaviours, so-called stereotypies. Stereotypies, or stereotyped behaviours, are defined as repetitive and unchanging behaviour patterns that lack a clear goal or function. Examples of stereotyped behaviours that can be seen in caged rabbits are pacing in corners, bar biting, excessive grooming, excessive feed consumption and playing with the nipple drinker.

Over the past 15 years, the housing of laboratory rabbits has evolved and more and more facilities have switched to group housing of rabbits in larger spaces, in order to meet their social needs. Research shows that rabbits housed in groups move around more compared to rabbits that are single housed. Group housing also favours social contact and rabbits housed together are often seen lying close, grooming and rubbing their noses against each other. Social housing of rabbits has also been shown to contribute to increased ability to handle stress, better physical status, improved digestion and normal physiological parameters.

# Fundamental conditions for good housing of rabbits

In order to house rabbits and offer them good animal welfare, certain fundamental conditions are required. In Swedish legislation, the following demands are required when housing rabbits, and other social animals, for scientific purposes:

- Laboratory animals that are not naturally solitary must be housed in stable social pairs or groups consisting of compatible individuals.<sup>1</sup>
- Introduction or reintroduction of laboratory animals into established groups must be carefully monitored and done in such a way as to avoid problems with compatibility and disturbed social relations.<sup>2</sup>
- Laboratory animals must be housed in a space of sufficient complexity so that they have the opportunity to perform a wide range of natural behaviours. The laboratory animals must also be given some opportunity to control and choose their environment in order to reduce stress behaviours.<sup>3</sup>
- Laboratory animals must have access to enrichment. The enrichment must be adapted to the species-specific and individual needs of the laboratory animals.<sup>4</sup>
- Rabbits older than 10 weeks must have access to an elevated area.<sup>5</sup>
- The laboratory animals must be able to lie down and sit on the elevated area, as well as move without difficulty on and under it.<sup>6</sup>
- Rabbits must have daily access to roughage.<sup>7</sup>

For rabbits, this means that they should be housed in groups with compatible animals. Compatible animals normally mean animals of the same sex and age that were put together before sexual maturity, as soon as possible after weaning. Since male rabbits defend their territories against each other, it is generally more difficult to house unneutered sexually mature males in groups. However, it may be possible provided that the males are put together at weaning, that the group is intact over time, and that they are given good opportunities to seek shelter and get away from each other.

The rabbits' space should be large enough to allow exercise and hopping gait so that the rabbits can jump and make quick changes of direction, which is an important part of their natural behavioural repertoire. Spaces for rabbits should be

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<sup>1</sup> 16 Kap. 15 § SJVFS (2019:9).

<sup>2</sup> 16 Kap. 16 § SJVFS (2019:9).

<sup>3</sup> 16 Kap. 18 § SJVFS (2019:9).

<sup>4</sup> 16 Kap. 19 § SJVFS (2019:9).

<sup>5</sup> 18 Kap. 2 § SJVFS (2019:9).

<sup>6</sup> 18 Kap. 2 § SJVFS (2019:9).

<sup>7</sup> 18 Kap. 5 § SJVFS (2019:9).

enriched and designed in such a way that the rabbits can perform a wide range of natural behaviours. For the same reason, the possibilities of housing rabbits in a larger space on the floor should always be considered before placing them in cages.

Something that Swedish laboratory animal facilities experience is the importance of socializing the rabbits, so that they get used to the people who look after and work with them. Rabbits who feel safe with the people that are going to handle them are generally perceived as less stressed. A lower basal stress level can make it easier for the rabbits to live in groups. In addition, if the rabbits are accustomed to situations that will occur in the study, such as being held, petted and touched where samples and injections will be performed, they may experience less stress in those situations than they would otherwise. This will also avoid elevated stress levels in the rabbits when they are returned to the group. Even on occasions where group housing is not possible, it is important to socialize the rabbits to reduce the stress they experience, especially given that social isolation is stressful in itself.

# To house rabbits in groups

In order to house rabbits in groups in a laboratory environment, they need to be given conditions where they can exercise their natural behaviours as far as possible. When rabbits are housed in groups, it is important to ensure that all individuals have the opportunity to use equal resources and also have the opportunity to get away in order to avoid aggressions and fights. In this section, we have gathered information that is important to consider in order to meet the needs of rabbits when they are housed in groups in a laboratory environment.

## Group composition

How successful it will be to put different individuals together depends on several factors, such as strain, individual characteristics, kinship, age, body weight, sex, enclosure size, who handles the animals, environmental enrichment and proximity to individuals of the opposite sex. Some individuals, especially males, can be very aggressive and create dominance hierarchies when housed in groups. It is therefore of great importance to carefully select individuals, and monitor the group regularly.

- **Compatibility of individuals.** To avoid aggression between the rabbits, they need to be of the same sex and as close as possible in age. Unneutered adult males that are not related should not be put together. If hormones are not important for the experiment, male rabbits should be neutered. Neutered males are less aggressive and are therefore usually possible to house together.
- **Age at introduction.** The younger the rabbits are, the lesser is the risk of aggression when they are put together. If possible, it is recommended that the rabbits are weaned together at around six weeks of age. Whole litters can also continue to live together if the males in the litter are neutered at around nine weeks of age.
- **Appropriate group size.** Studies have shown that rabbits thrive in groups of six to ten animals when they are put together at weaning, at about six weeks of age.
- **Long period of single housing.** If any of the rabbits have been housed alone for longer than six months, they may initially be more afraid of new impressions such as sounds, smells and other rabbits. The longer they have been housed in solitude, the more difficult it can be to group them with other individuals. Read more about what rabbits need when they live alone under the heading "When single housing cannot be avoided".
- **Housing at the breeders.** Check if the breeder can house and send rabbits in the pairs or groups they are to be housed in after arrival at the laboratory animal facility. In this way, the rabbits do not have to be regrouped after arrival, which reduces stress and the risk of aggression.

## Feed and water

- **Plenty of places for feed and water spread out in the cage or box.** By giving the rabbits at least one feeding and watering area per individual, the risk of competition is reduced since dominant individuals may guard valuable resources, such as feeding places and nipple drinkers. To further reduce competition, you can stimulate the rabbits' natural foraging behaviour by spreading feed throughout the enclosure.
- **Free access to roughage.** Free access to good quality grass or hay enables the rabbits to perform their natural eating behaviour and can reduce the risk of stomach and intestinal problems. By spreading the roughage throughout the enclosure and giving each rabbit its own feeding place, the risk of competition and the development of abnormal behaviours can be reduced.

## Living space and shelter

- **Maximise the living area.** Rabbits live on large areas in the wild and want as large an area as possible in a laboratory environment. When rabbits are offered at least 0.56 m<sup>2</sup> per rabbit, the chance for stable social housing increases.
- **Minimum of one shelter or hiding place per rabbit.** By giving each rabbit the opportunity to avoid conflicts by moving away, the risk of aggression and fights can be reduced.
- **At least one resting place per rabbit.** The enclosure needs to hold at least one resting place per rabbit. The resting places should preferably be spread out in the living area so that the rabbits can sleep at a distance from each other if needed. By putting resting places separate from food and water areas and hiding places, the rabbits are given a spot to groom where there is no risk of competition for resources.
- **Visual barriers, hiding places and elevated areas.** Rabbits that are housed in groups need to be able to seek shelter through hiding places, elevated areas or other visual barriers. It enables them to get away from potentially threatening conspecifics, and to choose whether or not they want to be in physical and visual contact with other rabbits. When rabbits are housed in groups, it is important that there are many hiding places, at least one per animal, to avoid that the rabbits develop resource defensive behaviours.
- **Preservation of scent markings.** Rabbits mark territory by urinating and defecating, as well as by rubbing their chin and cheek against objects. Preserving some of these markings when cleaning can help to keep the group calm.

## Enrichment

- **Safe placement of enrichment.** If rabbits are chased or stressed, for example in connection to being caught, they like to escape along outer edges and walls.



If the enrichment is placed next to the walls, the rabbits risk running into the enrichment and seriously injure themselves. By placing enrichment some distance from outer edges and walls, injuries can be prevented.

- **Enough enrichment for everyone.** If there are a few coveted resources, there is a risk that rabbits defend those resources against each other. To avoid this, there should be at least one set of enrichment items per individual.
- **Varying enrichment.** Offering the rabbits varied environmental enrichment can contribute to reduced aggression in the group, as it creates opportunities of choice for the rabbits and encourage them to explore the environment. Enriching the environment can, for example, be done by providing nesting material that the rabbits can manipulate and use for nest building, such as cardboard, or tunnels made of, for example, PVC pipes. Also scents, feeding that stimulates foraging or the opportunity to dig tunnels can constitute enrichment for rabbits.

# Introducing rabbits to group housing

Introducing rabbits to each other involves many new impressions and can be associated with stress. The stress may be expressed in different ways, such as circulated chasing, jumping or plucking of fur, and can cause injuries. The fact that the rabbits are stressed can also lead to aggression and fights. Careful preparation and a well-thought-out introduction can help reduce stress and thereby prevent aggression and fights between the rabbits. In this section, we list appropriate preparations for introduction, go through what is important to consider when introducing rabbits, and how to think and act if aggression occurs.

## Preparations

- **Individual markings.** By marking the individual rabbit's fur with non-toxic marking pens in different colours before introduction, the rabbits can be more easily distinguished when in groups. A suitable location for colour markings is the ears, where the colour is clearly visible and there is no risk of it being quickly groomed away. Avoid colours like red or orange if possible as they easily can be mistaken for body fluids.
- **Make sure that feed, water and hay is available.** Competition can occur between individuals at feeding time. By introducing the rabbits to each other only when feed, hay and water are already in place, competition in connection with feeding can be avoided. The availability of hay also stimulates the rabbits to perform their natural eating behaviour and can help reduce the initial stress.
- **Scent markings.** By ensuring that scents from all the rabbits are already present in a new living area, the risk of aggression as a result of territorial markings can be reduced. To spread scent from rabbits, you can take faeces and substrate with urine from the cages where the individual rabbits live and spread throughout the new mutual enclosure. When introducing rabbits to each other, you can also smear something palatable on their fur (mashed banana, jam, cream, orange juice or similar) so that they all smell similar. If females are to be housed together, urine from a male can be applied to the females' forehead or between the ears using a gauze pad or cotton ball. Urine marking from the same male indicates that the females belong to the same social group, which can help reduce aggression. Then place the female rabbits in the new living space at the same time.
- **Offer possibilities of contact.** If the rabbits are given the opportunity to see and smell each other through, for example, bars or net before introduction, they get a chance to get used to each other before being put together. The rabbits can also be offered a feeding place where they can eat near each other, but still separated by, for example, bars or nets.

- **File down the rabbits' claws.** Make sure the rabbits' claws are filed before assembly to reduce the risk of injuries.
- **Monitoring.** Create a plan on how to monitor the rabbits after they are introduced. It can be beneficial to use a camera to monitor the group and capture all behaviours. Rabbits often become fearful and inactive around humans, which can cause behaviours to be missed.

## At introduction

When the time has come to introduce the rabbits to each other, it helps if the surface is neutral and new to all individuals. When rabbits are put together for the first time, or after being separated for a period of time, it is important to monitor them. During monitoring you should both be able to quickly detect any signs of aggression and to observe behaviours that may indicate that the group is stable. Examples of behaviours that may indicate that the social introduction is successful are that the rabbits groom each other or that they eat, drink, or rest side by side. Feel free to use an ethogram or similar matrix to record behaviours (see an example in Appendix 1). During the first hour, continuous monitoring of the rabbits is recommended as this is the time when aggression most often occurs. If the rabbits show signs of aggression, the group needs to be monitored extra carefully until the rabbits have calmed down. If they do not calm down, it may be necessary to cancel the introduction, read more about when this may be relevant under the heading "If aggression occurs".

If the group is stable when an hour has passed, you can leave the room and follow up with shorter periods of monitoring throughout the day, for example 10 minutes on two occasions. If the group remains stable after that, the rabbits can be left together overnight. However, if the group is not ready to be left alone towards the end of the day, the rabbits should be separated. To be able to continue the introduction the next day, they should be separated in a way that enables them to maintain contact through sight and smell, for example with the help of a fine-mesh net that the rabbits cannot get stuck in. If the rabbits are left alone during the night, the caretaker needs to carefully feel through and inspect the rabbits' noses, fur and genitalia the following morning, to detect any injuries or wounds that may have occurred during the night. A veterinarian should be contacted in the event of wounds or other injuries. If no injuries are observed, the rabbits can be monitored for 10 minutes daily for the rest of the week. If the group is deemed to remain stable during the week, it can be considered established. Once the group is established, it is often alright to take a rabbit out for a short time, for example to take a sample, and put them back without further supervision.

## If aggression occurs

It is natural that some dissonance arises between the rabbits in connection to introduction. It is therefore important to observe how the rabbits interact with each

other in order to assess the stability of the group and detect any behaviour that may precede aggression.

The following are examples of communicative behaviours that can precede and escalate to aggression:

- A rabbit chases another rabbit.
- Mounting by another individual.
- Urine marking.
- Plucking of fur.
- Stomping.

Rabbits exhibiting any of these behaviours does not necessarily mean that they need to be separated, but it is necessary to follow up with additional monitoring to rule out it escalating into aggression. If the behaviour subsides, no action is needed. Always contact a veterinarian in case of wounds or other injuries in the rabbits.

If the situation requires it, the rabbits may need to be separated. Separating a rabbit from the group to instead housing it individually should always be carefully considered, as single housing is a major source of stress for social animals such as rabbits. The situation should always be assessed in regards to harm and benefit for the individual as well as for the group.

The following behaviours may be grounds for separation:

- Fights between rabbits.
- Rabbits biting each other.
- Rabbits repeatedly chasing each other.
- Presence of injuries with a high risk of infection, for example bleeding wounds, or injuries near the genitals or eyes.
- Excessive grooming of another individual.
- Mounting by another individual that risks causing harm.
- Recurrent defending of resources that risk leading to other rabbits not getting access to those resources.

If it is deemed necessary to separate the rabbits, you can start by separating them for a shorter time period. It might be a good time to inspect them and take care of any injuries. When reintroducing the rabbits, it is important to monitor them closely for at least an hour to ensure that the aggressive behaviours are not resumed.

Consider the possibilities of regrouping to avoid single housing. In the case of problems with aggression between two individuals in the group, the group can, for example, be divided into two smaller groups where the aggressive individuals are placed one in each group. If the situation on the other hand is one single individual not being accepted by the other rabbits, that individual can be put together with another compatible individual in a pair. In this way, no rabbit has to be housed

alone. If one or more rabbits need to be single housed for a longer period of time, it is important to ensure that their needs are met as much as possible. Read more about how to house rabbits alone in the best possible way under the heading "When single housing cannot be avoided".

# When single housing cannot be avoided

In some situations, it may not be possible to avoid single housing of rabbits. Some possible reasons for this could be preventing the spread of infection, a rabbit needing special care, or that an individual is not compatible with any of the others in the facility. Since rabbits are animals that live in social groups over large areas, it is difficult to meet their needs when they are single housed. If the rabbits are not given the opportunity to perform their natural behaviours, it can negatively affect their health and well-being, which in turn can have major consequences for the research results. Single housing of rabbits must be regarded as a temporary solution and according to Swedish legislation may only take place temporarily if no compatible animals can be found.<sup>8</sup>

If a rabbit needs to be housed alone, it is important to be aware of the consequences this may entail. The following are potential effects in rabbits when they are single housed and socially isolated:

- Impaired development of the brain.
- Increased heart rate.
- Increased number of white blood cells.
- Increased risk of illness.
- Decreased activity.
- Development of stereotypic behaviours.
- Signs of chronic stress, such as unkempt fur (for example urine stains in the fur or no or excessive grooming), moving in circles, bar biting, excessive scratching, digging on the cage floor and fear of, or aggression towards, people.

To minimize the negative effects of single housing, rabbits need access to social stimulation and the opportunity to perform natural behaviours. Below we have listed examples of things that can help to reduce the negative effects for the rabbits when they are single housed:

- **Living space that allows for natural behaviours.** The solitary rabbit needs to have a living area that is large enough to allow natural behaviours, such as hopping and rapid changes of direction. Housing in a larger space on the floor should always be considered before housing in cages.
- **Contact with conspecifics through sight and smell.** Rabbits that are housed alone benefit from being able to see and smell other rabbits and should be given the opportunity to do this according to Swedish animal welfare

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<sup>8</sup> 16 Kap. 15 § SJVFS (2019:9).

legislation.<sup>9</sup> If the rabbits are given contact through sight and smell, using, for example, a plexiglass with holes, bars or a net, it is important that the rabbits still have the option to choose whether they want visual contact or not. Such a possibility can be created by allowing a part of the partition wall to be non-transparent. Also keep in mind that the rabbits must not have the opportunity to harm each other.

- **Social stimulation.** By giving the rabbit access to, for example, a playpen where other rabbits have been, the rabbit can explore and examine other rabbits' scent markings and thereby get some social stimulation.
- **Regular monitoring.** It may be beneficial to monitor the rabbit continuously with the help of a camera, as rabbits often become fearful and inactive around humans. In this way, it is easier to detect any signs of impaired physical, as well as psychological welfare.
- **Offer a shared feeding area.** By giving the rabbit a feeding area that is shared with one or more other rabbits, separated by, for example, bars or a net, the rabbit can have company while it eats. However, it is important that the rabbit is given the opportunity to choose when it wants to eat in company. This can be done by offering at least one other feeding site, where the rabbit can eat in peace from other rabbits.

The advantages of group housing are, however, still far greater compared to single housing.

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<sup>9</sup> 16 Kap. 15 § SJVFS (2019:9).

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# Appendix 1

Observation protocol for monitoring of rabbits during introduction.

| Communicative behaviours                        | Observed | Time | Duration | Individual | Comment | Date/Signature |
|---|----------|------|----------|------------|---------|----------------|
| Chasing   |          |      |          |            |         |                |
| Mounting  |          |      |          |            |         |                |
| Urine marking                                   |          |      |          |            |         |                |
| Plucking of fur                                 |          |      |          |            |         |                |
| Stomping  |          |      |          |            |         |                |
| Aggressive behaviours                           | Observed | Time | Duration | Individual | Comment | Date/Signature |
| Fighting  |          |      |          |            |         |                |
| Biting  |          |      |          |            |         |                |
| Circulating                                     |          |      |          |            |         |                |
| Excessive plucking of fur from other individual |          |      |          |            |         |                |
| Mounting risking injury                         |          |      |          |            |         |                |
| Recurring defence of resources                  |          |      |          |            |         |                |

## Ethogram

**Chasing** – One rabbit lunge at another rabbit who runs away, resulting in one individual chasing the other.

This is normal when dominance is being established, as long as one rabbit is chasing and the other runs away.

**Mounting** – One rabbit stands with its front legs on top of the other. Mounting can occur both from the back and from the front and can resemble mating.

The behaviour has nothing to do with sexual activity but is a common dominance behaviour where the dominant rabbit mounts a submissive rabbit.

**Urine marking** – A dominant rabbit marks the cage or the submissive rabbit with urine.

**Plucking of fur** – A rabbit gnaw or lick the fur of another rabbit. The behavior often includes areas behind the ears, on the neck and on the nose.

The behaviour should not be confused with biting, which damages the skin and is an aggressive behaviour.

**Stomping** – A rabbit stomps its hind legs on the cage floor or on the ground.

A submissive rabbit stomps the floor followed by escape behavior, while a dominant stomp to threaten a submissive individual.

**Fighting** – Two rabbits quickly roll around together and sometimes appear to scratch or bite each other.

**Biting** – A rabbit uses its teeth to bite holes in the skin of another rabbit. This can result in bleeding wounds.

Biting is an aggressive behaviour and should not be confused with plucking of fur, which is a communicative behaviour.

**Circulating:** Two rabbits chase each other at the same time, resulting in a circular pattern.

This can happen if dominance is difficult to establish between two individuals.

**Excessive plucking of fur from other individual** – A rabbit picks the fur of another rabbit to a point where skin irritation or wounds occur.

**Mounting risking injury** – When a dominant individual mounts a submissive individual and either of them is at risk of injury. Unlike the communicative behavior, the rabbits may aim to bite each other in the genital area or fights may occur.

**Recurring defence of resources** – When an individual rabbit makes it difficult for other rabbits to access resources such as food, water or enrichment.

This can, for example, be done through lunges towards other rabbits who approach the resource.

**Severe injuries with open wounds that risk infection always constitutes grounds for separation. Contact the veterinarian if such injuries occur.**



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