

8 Summary

Use of cage space by laboratory rats

In this study it was investigated how laboratory rats use the space available to them in standard cages and if they spatially separate their behaviours. In addition, the effects of enlarging the floor surface area and of adding structure to the cage on the successful spatial separation of behaviours was studied.

We performed differentiated investigations on the use of cage space in six different cage types, in which we analyzed the distribution of behaviours and objects on the cage floor. 18 female Wistar rats between 4 and 21 weeks of age were housed and examined in stable groups of three animals per cage type. The experiment was repeated three times, so that a total of 54 animals was used.

The six cage types differed in floor and / or wall area. We used modified standard cages of the Macrolon® type III (about 800 cm²) and IV (about 1800 cm²) and a custom designed cage referred to as „type V“ (3800 cm²). We also enriched cages of all three sizes with an opaque plastic dividing wall positioned in the middle of the cage.

Using video tapes and the picture analysing system „DOTFINDER“, we determined the spatial distribution of the animals on the cage floor during the entire dark period (12 hours). Further, we determined the spatial distribution of ten defined behavioural patterns for individual animals by scoring selected 15 minute segments of video recordings (focal animal sampling, continuous recording), and using photographs we established the distribution of fecal pellets. In additional experiments we examined the spatial distribution of urine, cellulose paper and food pellets on the cage floor.

The animals in all types of cages stayed near the walls, and especially in size IV and V cages they remained largely in the corners. The behavioural patterns „resting“ „comfort behaviour“, „exploration“, „digging“, „rearing“, „play“ and „other social behaviour“ all primarily occurred here. Only „locomotion“ was distributed over the whole cage floor area. The majority of the dark period the animals stayed under the food hopper. In all cage types the fecal pellets, urine and food pellets were deposited primarily near the walls.

The most differentiated distribution of behaviours occurred in the cages of size V. Here, for example, the animals spatially separated the areas used for defecation from their main living areas. In the cages of size III, in contrast, the animals did not succeed in separating most of the behavioural patterns. The areas where the most fecal pellets were found were identical to the main living and resting areas. The cages of size IV showed intermediate results.

No areas used exclusively for resting were found in any cage type.

In the cages of size V the additional plastic dividing wall made the central area more usable, especially for depositing feces, urine and food pellets.

For nearly all behaviours the rats preferred structured places (corners, walls, the niche under the food hopper). Thus, the animals showed which areas in the cages were usable to them and that structure is critical to their choice of location.

The principle of performing behaviours in suitable places had priority over the principle of spatially separating different behaviours. Therefore, in the cages without sufficient suitable places, the animals were apparently forced to perform different behavioural patterns in the same location.

In the cages of the size V, particularly in cage type V with dividing wall, the animals probably had more suitable places available to them, due to the greater wall area, so that they were better able to spatially separate the different behaviours and were thereby able to achieve the best „specific space use“.

Using the successful spatial separation of different behaviours, especially of the main living and defecation areas, as the evaluation criterion, cage sizes III and IV appear to be inadequate. Through appropriate structuring of the cage floor area, however, it should be possible to increase the usable space for the animals and thereby to allow the spatial separation of behaviours even within a restricted cage space.