Video Article

Assessing burrowing, nest construction and hoarding in mice

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Abstract

When Richard Morris invented his water maze in 19846, rats were the subjects most researchers used in behavioural work. However, the greater understanding of mouse genetics and the subsequent development of techniques to create mutant strains led to the mouse becoming a vital tool in behavioural genetics. But researchers found that mutant mice were often prone to problems like passively floating or diving when they were tested in the Morris water maze. This was hardly surprising considering their natural habitat; rats swim naturally (classically, the "sewer rat") and even hunt for food in aquatic environments, whereas mice evolved in the dry areas of central Asia. To overcome these problems, I considered whether shallow water would be a sufficient stimulus to provide escape motivation for mice. This would also avoid the problems of drying the small creatures with a towel and then putting them in a heated recovery chamber to avoid hypothermia, which is a much more serious problem than with rats; the large ratio of surface area to volume of a mouse makes it particularly vulnerable to rapid heat loss. Another consideration was whether a more natural escape strategy could be used, to facilitate learning. Since animals that fall into water and swim away from the safety of the visible shore are unlikely to pass on their genes, animals have evolved a natural tendency to swim to the edge of a body of water. The Morris water maze, however, requires them to swim to a hidden platform towards the centre of the maze – exactly opposite to their evolved behaviour. Therefore our new paddling maze should incorporate escape to the edge of the apparatus. This feature, coupled with the use of relatively non-aversive shallow water, embodies the "Refinement" aspect of the "3 Rs" of Russell and Burch8. We experimented with various types of maze design; the common feature was that the water was always shallow (2 cm deep) and escape was via a tube piercing the transparent wall of the apparatus. Other tubes ("false exits" were also placed around the walls but these were blocked off. From the inside of the maze all false exits and the single true exit looked the same. The first maze5 was circular and worked well, but sometimes mice (particularly those with lesions to the hippocampus) would appear not to notice the open tube. An octagonal design, with the exit tubes placed in the corners so as to attract the attention of the mice, greatly ameliorated this problem. However, the error rate at chance performance was 4/trial, as opposed to 6/trial with the 12-tube circular design. Currently we are using a dodecagonal (12-sided) maze with 12 false/true exits set in the corners. In a recent development we have used a transparent paddling Y-maze successfully.

Disclosures

No conflicts of interest declared.

