Strain differences and lesion effects on reference memory revealed in the IntelliCage

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The IntelliCage allows fully automated testing of various forms of learning and memory. With the test modules applied so far, the mice remained in the IntelliCage during the whole experiment. We have now tested whether mice are able to recognize places and show conditioned responses also after a delay during which they were housed outside the IntelliCage. To induce avoidance of one of the four learning corners, attempts to drink from that corner were punished with an air puff for 24h. After training, the mice were placed in regular cages for 24h. During the last 18h, the mice were water deprived and then returned to the IntelliCage for a probe trial during which drinking was allowed in all corners. C57BL/6 mice developed strong place avoidance during training and clearly continued to avoid the old punished corner during the probe trial. When the procedure was repeated using a different corner and the same mice, performance remained at the same level, suggesting that the procedure may be applied repeatedly to monitor memory performance over time. When we compared three mouse strains (C57BL/6, DBA/2 and C57BL/6 x DBA/2 F1), we found that DBA/2 and F1 mice performed more poorly than C57BL/6 in the probe trial, despite showing similar error rates during training. Performance in the probe trial depended on the intensity of punishment: only long, but not short air puffs induced significant place avoidance in DBA/2 and F1 mice. We also applied the test to mice with bilateral excitotoxic lesions of the hippocampus or of the prefrontal cortex. Mice with hippocampal lesions made significantly more errors during training and performance above chance level in probe trial was achieved only using long air puffs. In conclusion, the method seems to be a promising approach for studying reference memory, although further validation is required.

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