Natural learning in free-living populations: food place reversal in mice overexpressing the cell adhesion molecule L1

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Transgenic mice overexpressing the neural cell adhesion molecule L1 are known for slightly superior place reversal learning in the water maze learning (Eur. J. Neurosci 10: 708-717, 1998). In order to test mouse learning abilities under more naturalistic conditions, we have developed computerized set-ups that permit to monitor simultaneously the spatial behavior of many transponder-tagged mice living in large outdoor pens. In this study, we asked whether L1 transgenic mice would show comparably superior place reversal learning following relocations of distant food sources.
77 mice of a mixed F2-background (DBA/2 x C57BL/6) were tagged with transponders and then released into an outdoor pen (20 x 20 m) for 67 days (hetero- or homozygous transgenics: 27 males, 28 females; wildtypes 10 males, 13 females). Eight computer-controlled antennas recorded every visit of a microchip-tagged mouse during the entire observation period. Mice lived mainly in two central and adjacent shelters of 2x2 m, each one containing one antenna. The other six antennas were placed in the open area of the pen at variably distant locations. Food was delivered for 19 days inside the shelters. After this, the location of food delivery was changed several times and we observed the adaptation of the mice by recording the order and the number of visits at rewarded and empty sites.
After stopping food delivery inside the shelters, the transgenic animals increased their searching activity significantly more than wildtype mice ($p < 0.01$), at least for some of the antennas. In addition, transgenic mutants returned to the previous food locations less frequently ($p<0.02$).
Thus, testing reversal learning under naturalistic conditions confirms the predictions based on water maze learning. On the other hand, analysis of short-term survival during the observation period shows no advantage for the transgenic mice.

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