The behavioural differences between C57B6L/6 and 129Sv mice are reproducible in mice reared in distinct environmental conditions

Urho Abramov, Triinu Puussaar, Sirli Raud, Kaido Kurrikoff, and Eero Vasar
Department of Physiology, University of Tartu, Estonia, Urho.Abramov@kliinikum.ee

Introduction

In a study initially published by Crabbe *et al* (1999) and later discussed in more detail by Wahlsten *et al* (2003) a major conclusion was drawn, that the behavioural differences with large effect size between the mouse strains could be reproduced in different laboratories, whereas the differences with small effect size would be more prone to modification by laboratory environment. We have recently reported that the phenotype of mice, lacking cholecystokinin CCK-2 receptors, could not be reproduced within our laboratory if mice had been reared in different housing conditions (Abramov et al, *in press*), partially explaining large number of contradictory reports on these mutants over past 10 years. Provided that the mice, lacking CCK-2 receptors, did not significantly differ from their wild-type littermates in terms of genetic background, the present study was designed to reveal if the behavioural phenotypes of genetically distinct strains could be reproduced in mice reared in distinct environmental conditions within our laboratory. Environmental enrichment was used as an alternative environment to standard laboratory conditions as suggested by Würbel (2002).

Methods

Studies were performed in male and female C57Bl/6 (B6, Scanbur BK) and 129S6/SvEv/Tac (129, Taconic) mice. After weaning at 3 weeks mice were randomly allocated to either standard or enriched conditions for 7 weeks before start of experiments. Standard housing conditions consisted of standard laboratory cages with bedding, whereas enriched conditions consisted of larger cages containing bedding, nesting material, stainless steel wheels or swings and aspen houses, igloos, ladders, tubes or labyrinths, which were changed and repositioned once a week. For behavioural phenotyping the plus-maze, locomotor activity, hot-plate and forced swim test were carried out (for details, Abramov *et al*, *in press*).

Results

Significant genotype-dependent differences were established in all tests. 129 strain displayed significantly lower exploratory activity in the plus-maze (Fig. 1) and locomotor activity test (Fig. 2) than B6 strain. Also, significantly longer latencies to hind-paw reaction were observed in 129 strain in the hot-plate test when compared to B6 strain (Fig. 3), and 129 strain spent substantially larger proportion of time immobile than their B6 counterparts in the forced swim test (Fig. 4). With the exception of the plus-maze test, the differences between B6 and 129 strains were significant, irrespective of pre-experimental housing conditions. Interestingly enough, behavioural differences between strains were even more pronounced in mice reared in enriched conditions.

Conclusions

The present study demonstrates, that 129 strain displays lower exploratory activity, longer hot-plate latencies and spends more time immobile in the forced swim test when compared to B6 strain. These behavioural differences were reproducible in mice reared in distinct environmental conditions, indicating clear genotype-dependent effects rather than genotype by environment interaction effects. In the light of previous findings (Abramov et al, *in* press), these results suggest, that rearing in two distinct environmental conditions is a meaningful approach in behavioural research and can be applied to dissect a phenotype into effects arising from genes, environment or the combination of both.

References

1. Abramov U et al. (*In press*) Different housing conditions alter the behavioural phenotype of CCK_2 receptor deficient mice. *Behav Brain Res*.
2. Crabbe JC et al. (1999) Genetics of mouse behavior: interactions with laboratory environment. *Science*, **284**, 1670-1672.
3. Wahlsten D et al. (2003) Different data from different labs: lessons from studies of gene-environment interaction. *J Neurobiol*, **54**, 283-311.
4. Würbel H. (2002) Behavioral phenotyping enhanced – beyond (environmental) standardisation. *Genes Brain Behav*, **1**, 3-8.

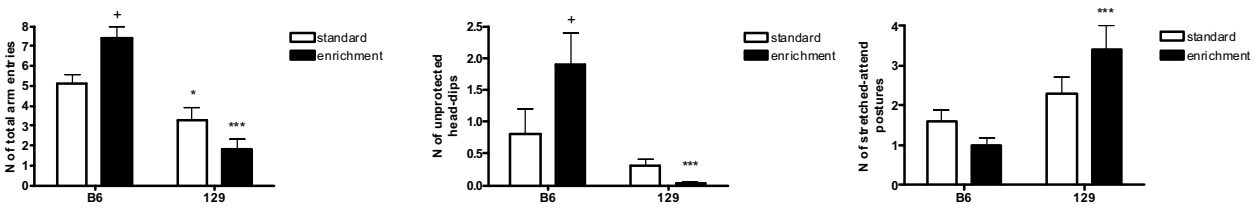

Figure 1. *Plus-maze test in B6 and 129 strains, housed in different environmental conditions. (A) total number of arm entries; (B) number of unprotected head-dips; (C) number of stretched-attend postures. * p<0.05, *** p<0.005: 129 strain compared to B6 strain housed in the same conditions; + p<0.05: mice housed in enriched conditions compared to mice of respective strain housed in standard conditions.*

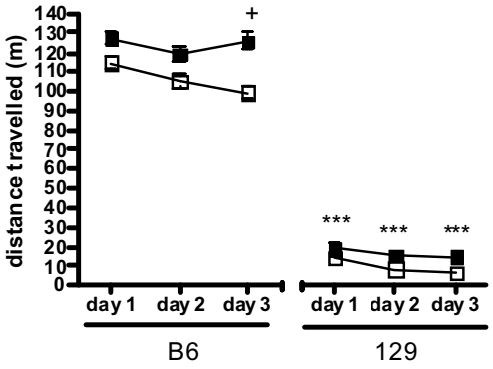

Figure 2. *Locomotor activity in B6 and 129 strains, housed in different environmental conditions. *** p<0.005: significant differences between 129 and B6 strains on the same day irrespective of housing conditions; + p<0.05: B6 strain housed in enriched conditions compared to B6 strain housed in standard conditions on day 3.*

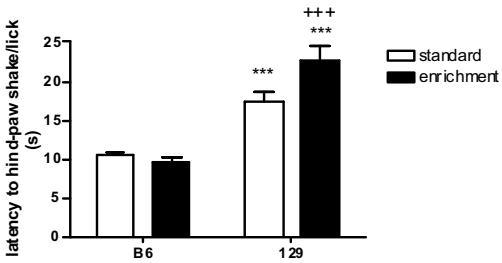

Figure 3. *Hot-plate test in B6 and 129 strains, housed in different environmental conditions. *** p<0.005: 129 strain compared to B6 strain housed in the same conditions; +++ p<0.005: 129 strain housed in enriched conditions compared to 129 strain housed in standard conditions.*

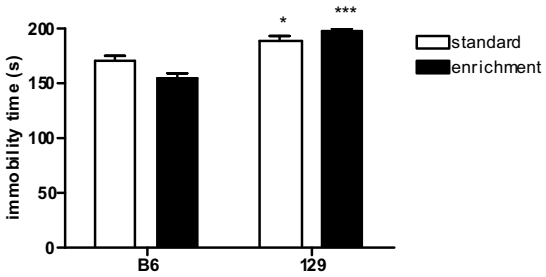

Figure 4. *Forced swim test in B6 and 129 strains, housed in different environmental conditions. * p<0.05, *** p<0.005: 129 strain compared to B6 strain housed in the same conditions.*