Lack of consistent differences between female and male mice during place navigation in the water-maze

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Summary

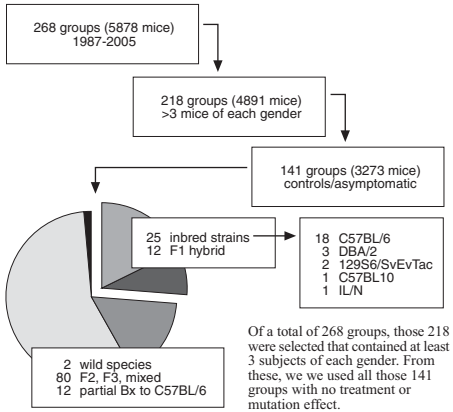
The water-maze place navigation task is one of the most frequently used paradigms to assess cognitive function in mice. Many studies use only male subjects because female mice are thought to perform more poorly and to be more variable due to their estrous cycle. That experimental manipulations of the hormonal status affect water-maze performance has been documented in several studies, but systematic gender comparisons under routine laboratory conditions are missing.

During the period 1987-2005, we have been using the same standardized place navigation protocol and have tested 218 experimental groups that contained both female and male mice (total 4891 mice, median group size 19). In our routine procedures female subjects are tested regardless of their cycle state. Experimental animals are housed in the same room which favors synchronization. Retrospective comparison of female and male performance levels in a subset of 141 unimpaired groups confirms a small but significant trend with male mice performing overall slightly better than females, both during training and in probe trials. However, this trend accounts for only about 1% of the variability in the data with gender differences remaining unpredictable at the level of the single study. Systematic comparison of variances in female and male subgroups does not reveal consistent differences. Overall, probe trial scores tend even to be less variable in females than in males.

Conclusion

Taken together, these data indicate that female and male mice are equally suitable test subjects for place-navigation tasks in the water-maze. When phenotyping mutant mice it is thus advisable to test animals of both sexes which permits to catch gender-dependent mutation effects.

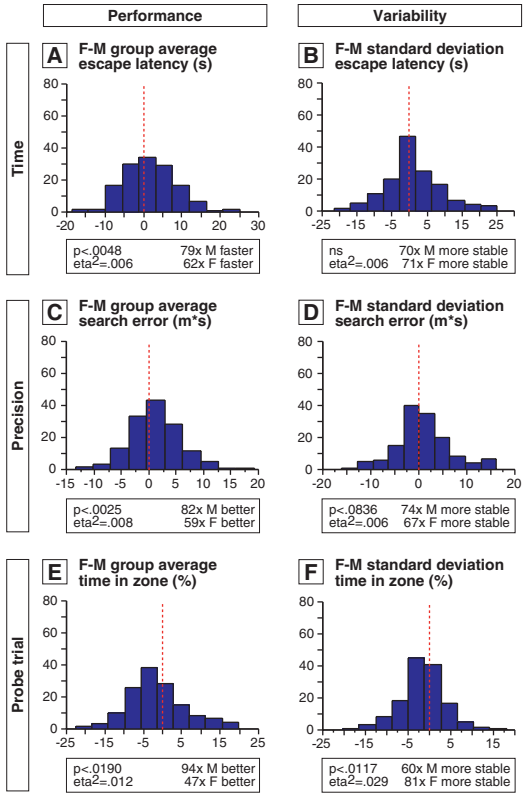
Retrospective analysis of 3273 normal mice



Of a total of 268 groups, those 218 were selected that contained at least 3 subjects of each gender. From these, we we used all those 141 groups with no treatment or mutation effect.

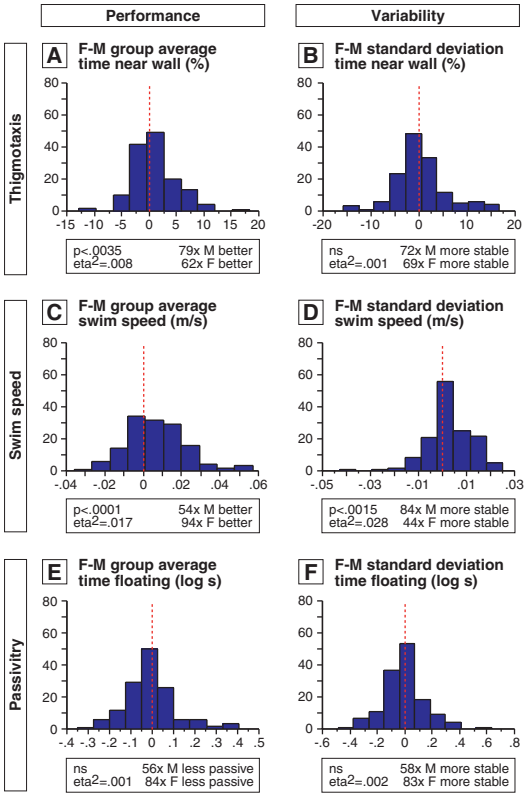
Water-maze methods. Pool diameter 1.5m. 3 days x 6 trials acquisition & 2 days x 6 trials reversal, max. trial duration 120s, ITI 30-60 min, probe trial = first of reversal. Video-tracking by Noldus EthoVision 3.0, off-line data analysis by Wintrack 2.4

Minimal male performance advantage is not predictive for individual groups



Gender effects on training (ABCD) and probe trial (EF) measures. Average (ACE) and standard deviation (BDF) were calculated for each female and male subgroup and female-male differences plotted as histograms. Positive numbers in (ACE) indicate larger group means in females. Positive numbers in (BDF) indicate greater variability in females. Femlae-male differences were tested against zero using one-sample t-tests. The proportion of variance explained by the gender factor is expressed as eta^2.

Male-female performance difference is not explained by wall hugging or passivity



Gender effects on non cognitive performance factors during training: thigmotaxis (AB), swim speed (CD) and floating (EF). Average (ACE) and standard deviation (BDF) were calculated for each female and male subgroup and female-male differences plotted as histograms. Positive numbers in (ACE) indicate larger group means in females. Positive numbers in (BDF) indicate greater variability in females. Femlae-male differences were tested against zero using one-sample t-tests. The proportion of variance explained by the gender factor is expressed as eta^2.

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