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Selecting mice for high cognitive abilities

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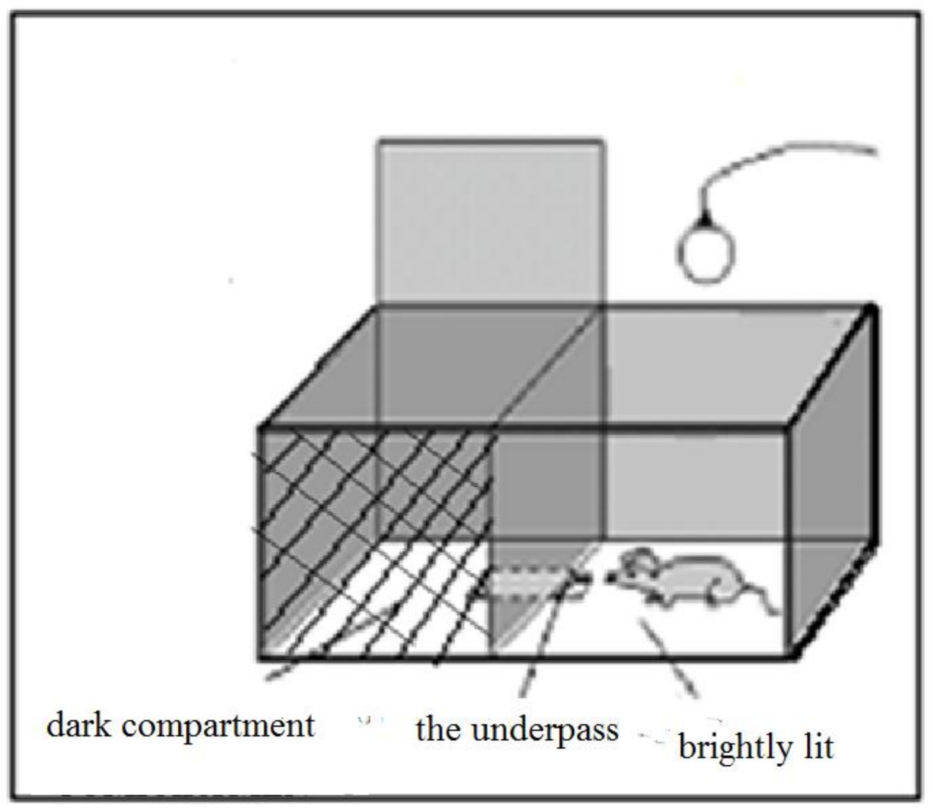
The genetics of cognitive abilities is the object of neurologists from the early days of genetics *per se*.
Initially there were the traiys , connected with learning processes (early selection experiment of R. Tryone), The classification of animal cognition (expressed while learning) includes up to 8 levels (R.K.Thomas, 1996). This was (and still is) absolutely correct, but animal cognitive abilities is the more broad concept. This means that the ability to solve the elementary logic task is really one of the components of animal intellect.

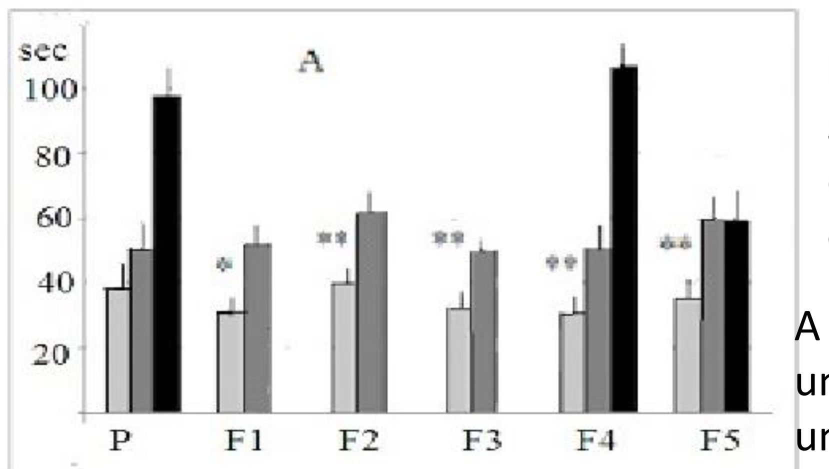
The puzzle box test, introduced into the experiments with laboratory mice by M. Galsworthy and colleagues (2005) is a problem-solving task, in which mice are required to complete escape reaction of increasing difficulty within a limited amount of time.

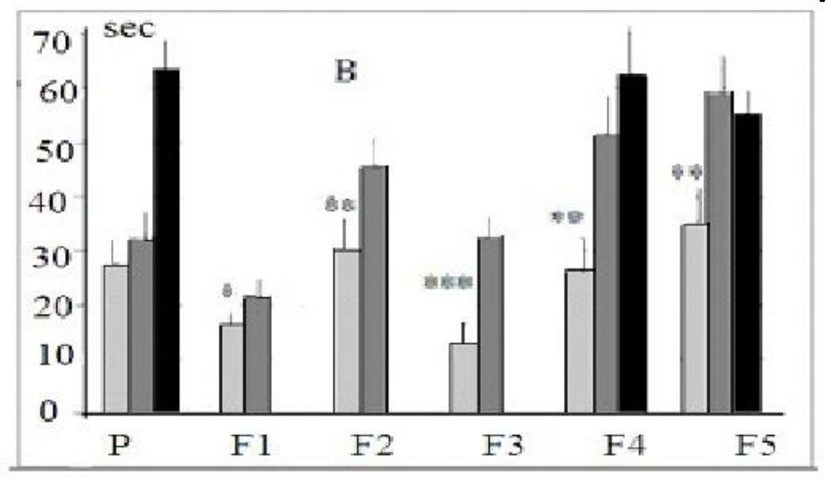


During the puzzle-box test an animal is eager to penetrate (enter) the dark part of the box, avoiding the brightly lit one. The test contains four stages: 1 - with no obstacle for such avoidance reaction, 2 - the underpass, leading to the dark, was masked by wood shavings, 3 and , 4 the underpass was blocked by the plug (carton- plastic), which animal can remove either by teeth or by muzzle.
See photos at the right

The bidirectional selection of mice was performed for the successful elementary logic task solution (+ mice) and for the lack of such success (- mice) during the "plug" stages of the puzzle-box test. The shortened version of "puzzle-box" test was used (in comparison to that in Galsworthy et al. 2005), as this testing requires only one experimental day and also minimalizes the animal habituation to the procedure. The 5 generations of selection demonstrated the significant differences both in the duration of solution latencies and in the proportion of animals which were able to solve the most complicated stages (plug stages) of this test.

Mice, previously selected for the high scores in extrapolation test, were used as the initial population the present selection. The extrapolation score in this selection were initially up to F8 higher that 50% chanc level (normal for lab. mice), but later the scores becam variable? Although the percentage of mce capable to solve the puzzle box in these generations were rather



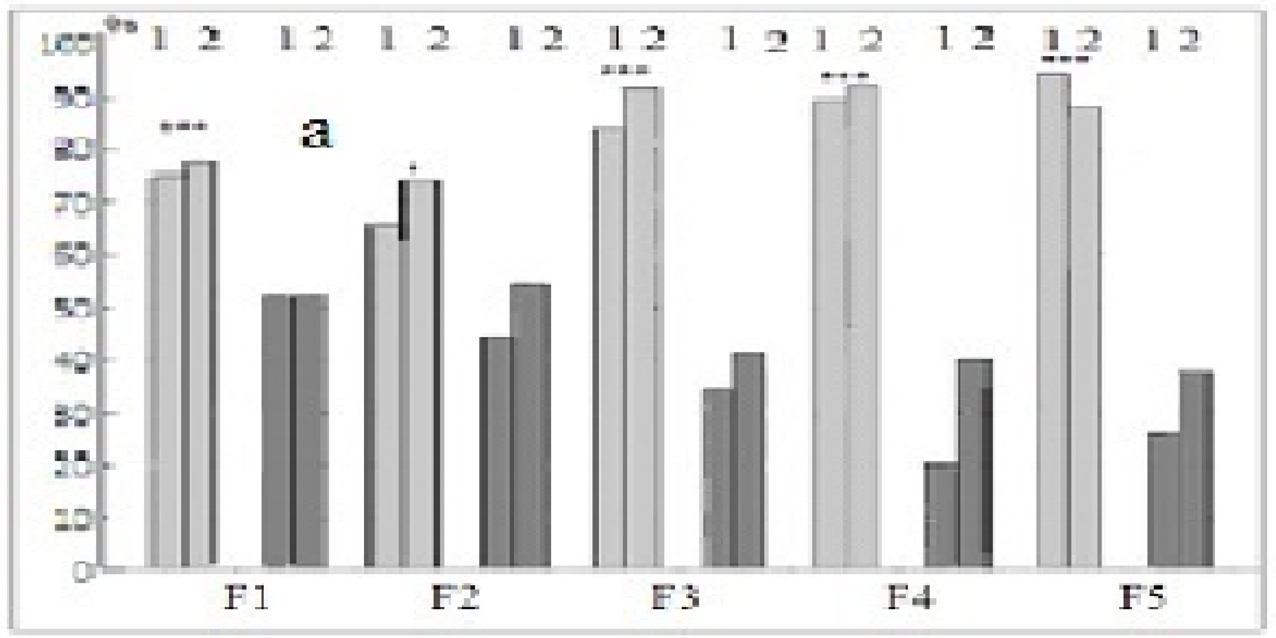


Mean latencies (± st.e sec, ordinate) for mou entering into the dark of the experimental b

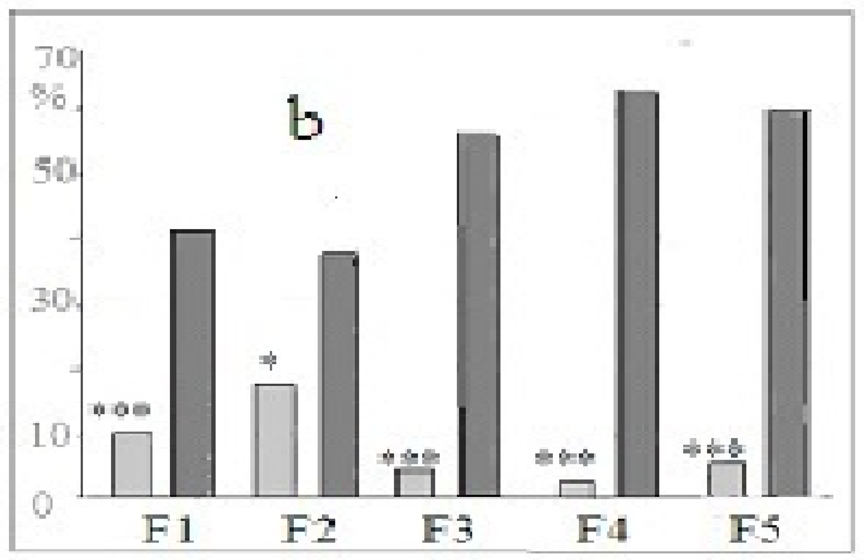
A - the underpass was unobstructed. B - the underpass is masked by wood shavings. P-paren

Light grey columns – "plus" selection strain dark grey "minus" selection, black contro black -non-selected, heterogeneous population.

*, ** - significantly different from the respective values for "minus" and control mice (p<0.05 and 0.01 respectively (post hoc Fisher LSD test, one way ANOVA).

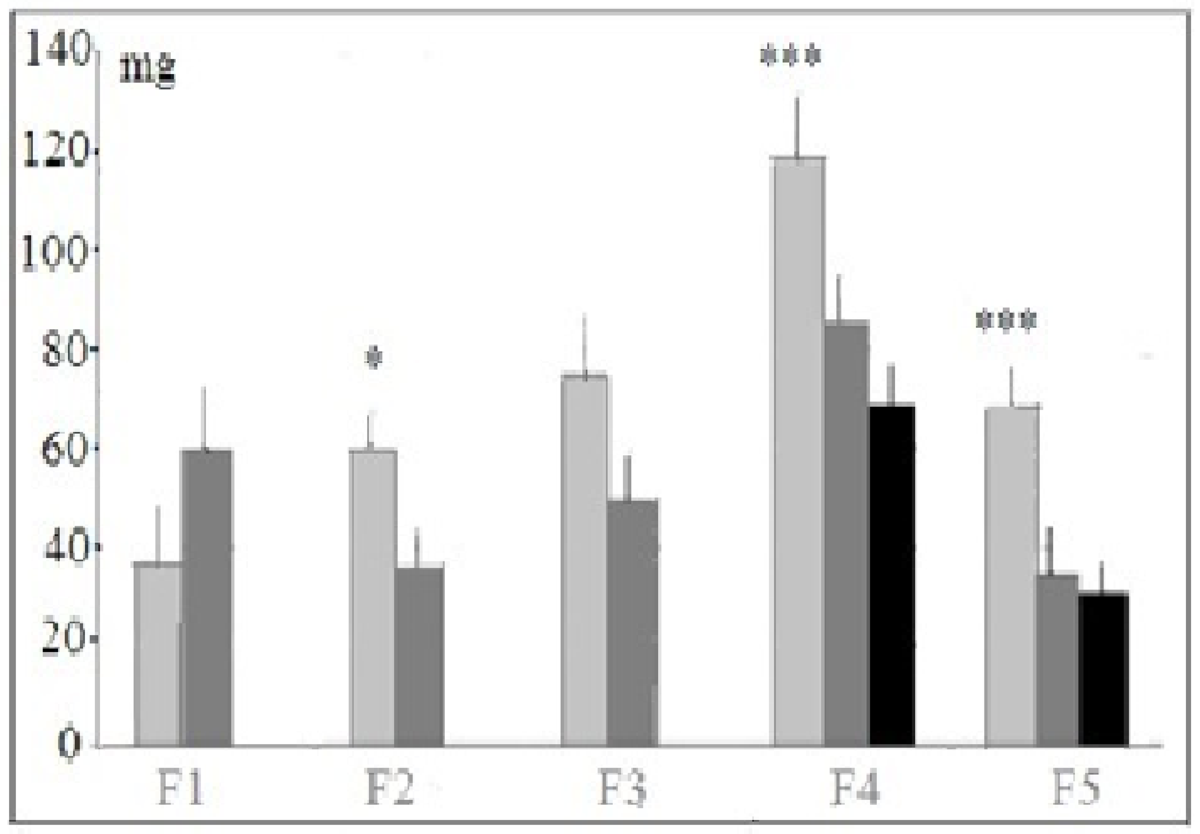


A- Proportions (%, ordinate) of animals in F1-F5, which were able to solve the puzzle-box the underpass was blocked by the plug (stages 3 and 4, designated as 1, 2 digits above the columns).



B Summarized data for the proportions (%, ordinate) of animals in F1-F5 which failed to solve both puzzle-box "plug" stages. (3 and 4, the underpass blocked by the plug).

"Plus" selected mice ate significantly more new food (mg, ordinate) in new environment (hyponeophagia test) than "minus" selected animals



Animal numbers (for "+" and "-" strains respectively) were the following
F1 ("+") 31 ♂♂, 29 ♀♀, F1 ("-") 22 ♂♂,17 ♀♀,
F2 ("+"), 28 ♂♂, 30 ♀♀, F2 ("-") 22♂♂, 27 ♀♀,
F3 ("+") 41 ♂♂, 42 ♀♀, F3 ("-") 28♂♂, 18 ♀♀,
F4 ("+"), 39 ♂♂, 33 ♀♀, F4 ("-") 26♂♂, 18 ♀♀,
F5 ("+") 27 ♂♂, 39 ♀♀, F5 ("-") 44 ♂♂, 47 ♀♀

The data obtained show the significant differences in "plug" stages solutions in mice of selected lines ("plus" and "minus" lines respectively) as well as the differences of "plus" line scores from those of animals from the initial unselected genetically heterogeneous population.

The conclusion from data obtained is that not only the ability to solve the elementary logic task was increased in generations, but, presumably, the "executive functions" expression in these mice was affected by selection process as well.

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