Laboratory mice – ready-made for animal studies?

Laboratory animals, most of them mice, are bred and used to model human diseases. On one hand this offers great possibilities for science, one the other hand this topic is controversially debated. Beside ethical concerns, the major arguments against animal studies are 1.) Mice are animals not humans and do have animal-specific features, and 2.) Such animals live under non-representative, i.e. artificial conditions, which do not mimic the situation in men.

Standardization of animal husbandry aims at resolving respective challenges and is thought to prevent false results. Anyway, mice cannot be fully standardized!

Under realistic conditions, mice carrying particular genetic manipulations, are used for breeding as long as it works. Model organisms with alterations in target genes for particular diseases are precious and many times husbandry resources are limited.

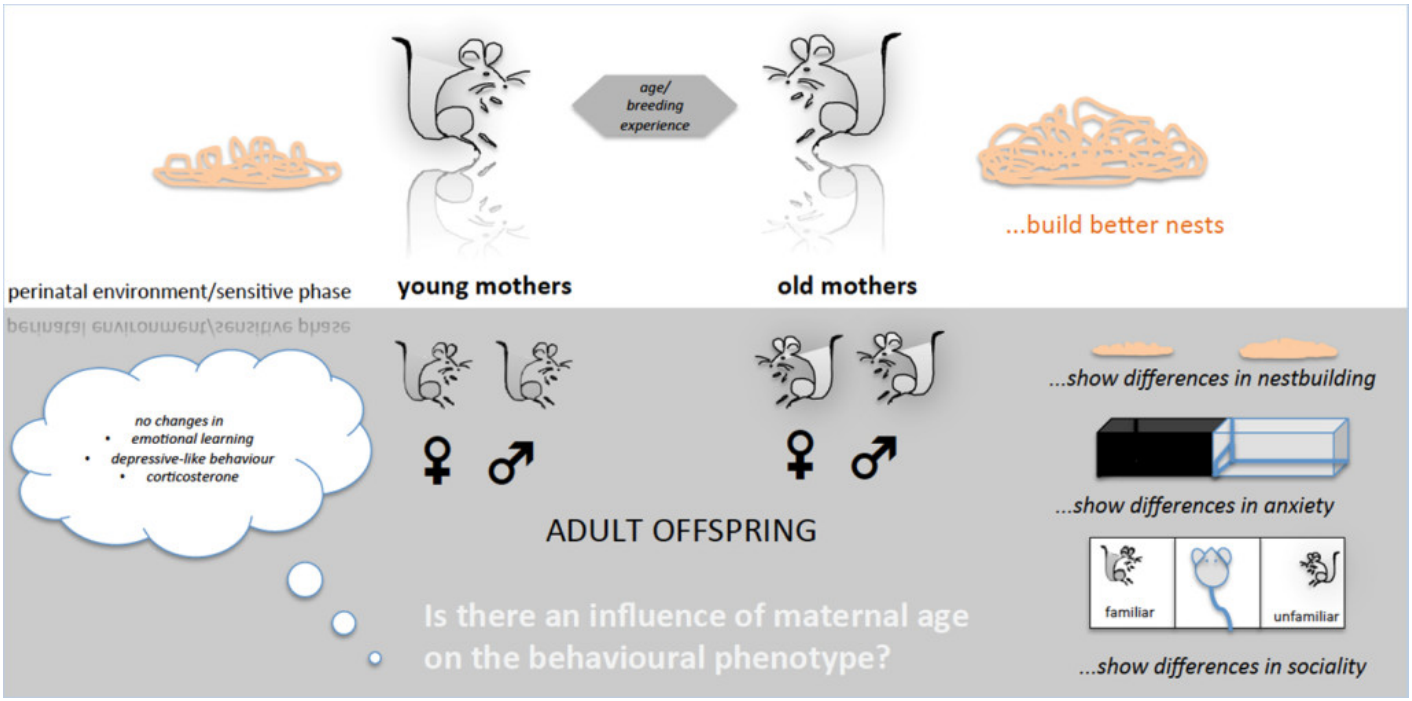

Fig. 1. Maternal age matters. Offspring demonstrates differences in emotional behaviour.

Since this leads to the fact that mice are utilized as soon as they are mature, as long as they mate, we were interested in potential differences in the “mousy products”. Does it make a difference, whether mouse mommies are young or old? Are all mice “the same”, independent of age and experience of their mothers?

The investigation of maternal and offspring behaviour in a test battery for emotional behaviours (nest building, exploration, anxiety, social and depressive-like behaviour) revealed clear differences. Hand in hand with age and breeding experience we found an enhanced nest building performance in older mothers.

Offspring of those mothers were also affected by maternal age. Behavioural alterations occurred not only in nestbuilding, but also when anxiety and social interactions were examined.

Experimental setup: the analysis of nestbuilding was done by help of customary-defined scores. Anxiety was assessed in a so-called Dark-Light Box where mice can choose their preferred compartment, i.e. a dark, or brightly illuminated one. Being nocturnal animals, usually they spend more time in the dark part, but are at the same time exposed to an approach-avoidance conflict when they do have the choice. Sociality was examined in a “Social preference” test. In this paradigm mice are exposed to familiar and unknown counterparts. Naturally, mice are more prone to “investigate” new mice when they are allowed to make the choice.

Interestingly, in our study female offspring of young mothers seemed to be especially affected by maternal age. The behaviour presented here indicated an initially decreased social interest, later reduced social recognition that is in mice associated with an autism-like phenotype. Though, it was not accompanied by changes in stress-hormone release (corticosterone in mice, which resembles cortisol in humans).

Although being not primarily interested in animal models for experimental psychiatry, one has to note that certain conditions in mouse breeding facilities are not trivial. Especially when animal studies focus on affective disorders, which are hard to imitate anyway, it has to be kept in mind that there is no “uniform animal”.

Conclusion: Since it is impossible to work with ready-made mice, not even under highly standardized laboratory conditions, it seems plausible to consider naturally occurring processes such as “mice age”. However, this might need complete rethinking when planning and interpreting results of animal studies. On the other hand this bears the chance to improve the reproducibility of biomedical analyses, make them more representative and thereby increase the validity of results and animal welfare. Every mouse counts!

Publication

Mice age - Does the age of the mother predict offspring behaviour?
Lerch S, Brandwein C, Dormann C, Gass P, Chourbaji S
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