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High mortality rates among newborn laboratory mice – is it natural and which are the causes?

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Maternal behaviour is a key-factor in offspring survival, especially in species with altricial young such as rodents that give birth to large litters of relatively undeveloped young totally dependent on their mother for nutrition and thermoregulation. Since mice are born ectothermic and have poor thermoregulatory abilities up to 2–3 weeks of age, the construction of a brood nest is important for successful rearing of young [1]. In the wild, mice generally build nests of hair, grasses and other soft plants. Even in the laboratory, adult mice with access to nesting material build a nest in which they sleep and preparturient and lactating females build particularly elaborate nests (reviewed in [2]). While normally taking care of the offspring and providing them with food, shelter, and warmth, under certain circumstances house mice are reported to be infanticidal [3]. Even though a newborn infant represents a large investment, maternal infanticide could result in net benefit for surviving offspring and parent under certain environmental conditions [4].

In the laboratory environment, there is no physical risk of predation or starvation. However, population density is extremely high and humans moving about in the room may be experienced as potential predators by the animal, in particular if directly handling female and pups as when cleaning cages. Loss of litters is experienced as a problem in laboratory mice facilities. High mortality rates as a consequence of disease or malformations in offspring are not expected in healthy mouse strains, and infanticide is therefore thought to be one important cause of pre-wean-

ing mortality and generally considered to be stress induced. Usually the entire litters are lost, and so besides being a direct welfare problem, infanticide also leads to an increase in the number of breeding stock needed to supply experimental animals.

We examined the survival rate of 539 litters of mice from two of the most commonly used laboratory strains (C57Bl/6 and Balb/c) bred under normal husbandry procedures, and found that mortality rate (that is whole litters lost) was at average 28,9%. In an experimental study we investigated the influence of housing environment on maternal behaviour and found a significant difference in survival between two different housing environments. Litter survival was 100% in furnished housing (n = 9) and 50% in barren housing (n = 10) (Fisher's exact test, P = 0,033). These findings made us question why the mortality rate among newborn litters of mice is so high and whether this was due to infanticide or not.

Mice are often used as model animals in laboratory studies of infanticide, research which has focused on male infanticide and on the inhibition of infanticide and onset of parental care [4]. However, even though loss of litters is a common phenomenon in reproductive units of mice, so far no research has addressed the factors underlying infanticide under normal animal facility conditions.

As indicated by the large difference in survival, pup welfare was strongly affected by housing treatment. But not

all mice kept in barren housing were infanticidal, and we are presently investigating the role of peripartum behaviour of the female in offspring survival, using video recordings made before and after parturition. A comparison between infanticidal and non infanticidal females will provide information on differences in maternal behaviour which may explain the difference in infanticidal tendencies. So far, no loss of litters was registered after day 3 postpartum and no results from our behaviour observations indicate that the female actively kill her pups. It seems as if rather than killing pups, females eat pups that are already dead.

It is still not clear whether the high frequency of litter loss among laboratory mice is due to reduced maternal abilities and/or increased stress sensitivity of the mother. It is possible that rather than actively killing their litter, mice may fail to provide appropriate care leading to infants dying from hypothermia or starvation. In the absence of detailed information on the course of events, instead of being seen as infanticide – the killing of conspecific preweaning young [5] – it might be more appropriate to talk about litter loss and the fact that females eat their pups referred to as cannibalism – a species eating a member of its own kind. Strong evidence for infanticide as a major cause is presently lacking.

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