

Enrichment Improves Colony Success

Two Case Studies

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Introduction - The Power of Enrichment

Enrichment has been recognized as an integral part of animal care and is essential for meeting the physical and psychological needs of the research animals, which can facilitate more consistent and reliable research results. Its importance became evident in the 2011 edition of the *Guide for the Care and Use of Laboratory Animals (OLAW)*. The Housing section of this edition added 2 pages dedicated to enrichment, and 21 references listed in the index under 'Enrichment'. Also, the Appendix now includes 44 articles pertaining to Environmental Enrichment. Enrichment is added to encourage natural behaviors such as foraging and nest building, as well as improved learning and memory, and increased fertility and pup survival. It can also result in a reduction of undesired behaviors such as aggression, stress and stereotypic behaviors. There are multiple enrichment options, including the two which have shown positive results on mouse colonies in our facility that had a history of poor fertility and pup survival.

Types of Enrichment

Enrichment essentially falls into four categories:

Environmental- Comes in many different forms, with a purpose of mimicking the natural environment. Examples:

- shelters (reusable plastic, disposable cardboard)
- Nesting materials such as paper towels, tissues, shredded bedding, compressed cotton squares
- Raised perches and nesting boxes
- Primates benefit from rope 'vines'

Toys - Items that the animals can manipulate. Examples:

- Rodents--Exercise wheels, chew toys
- Pigs--balls, barbells, empty plastic bottles
- Cats--balls, hanging objects, scratching post

Social—group house or single house

- According to the 2011 Guide (p. 51), social animals should be housed in stable groups, unless necessary for experimental reasons.

Dietary— encourages natural foraging behavior. Examples:

- Mice: sunflower seeds, whole oats, peanuts, raisins
- Mechanical and physical tasks to achieve a food reward, especially for primates

Additional Points to Consider

The animal technician is key to recognizing the need for enrichment. One should observe animals for signs of boredom, stress, aggression or stereotypic behavior. If any of these exist, consider adding enrichment to the cage. When deciding on an appropriate enrichment, there are many resources available, such as published articles and other animal care workers in the field. And remember, what works for one strain of mice may not be appropriate for another. Also, it is paramount to check with the Principle Investigator to make sure that the enrichment won't interfere with a research project (such as a food treat given during a dietary study). It is important to be consistent, adding the same enrichment to all cages so that it won't have an unequal affect on the animals, and potentially the research. Follow up to make sure the enrichment has the desired effect.



Study 1: Adding Environmental Enrichment

Introduction:

The littering dams in the SLB colony appeared skittish and demonstrated stereotypic behaviors such as racing and flipping in their cages. Many of these mice didn't make nests or care for their pups, which consequently lowered pup survival. From these observations, it was speculated that the addition of an environmental enrichment could be beneficial. After researching various options, it was decided to add an enrichment tube to each cage.

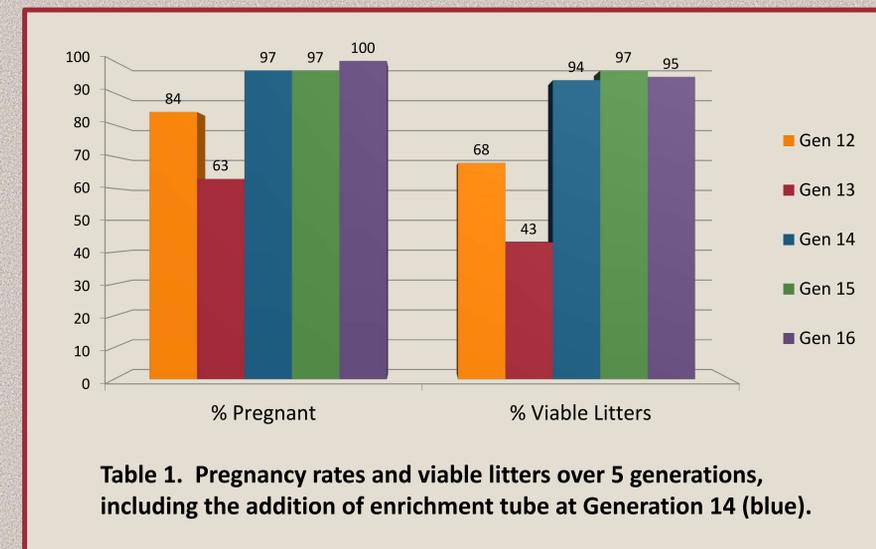
Materials and Methods:

A 3" length of 1 1/4" PVC tube was introduced into each cage. It would serve as a place for the mice to hide in and climb on. The tube was initially added to the mating cage so the animals would become accustomed to it. The tube was kept with the dam when transferred to a clean littering cage. An additional benefit is that it also served to carry the scent over into the clean cage, which should help lower cage-change stress.

Results:

Immediate positive results were observed, as displayed in Table 1. Pregnancy rate increased from 84 and 63% to 97% in Generation 14 (blue); pregnancy rate remained high in the two following generations. Percent viable litters refers to the litters that survived until weaning. This jumped dramatically, from 68 and 43% to 94% after the addition of the enrichment tube. Pup survival continued to remain high in the next two generations, as well.

Due to the significant improvement in pregnancy rates and pup survival, we added an enrichment tube to all of the cages in our facility.



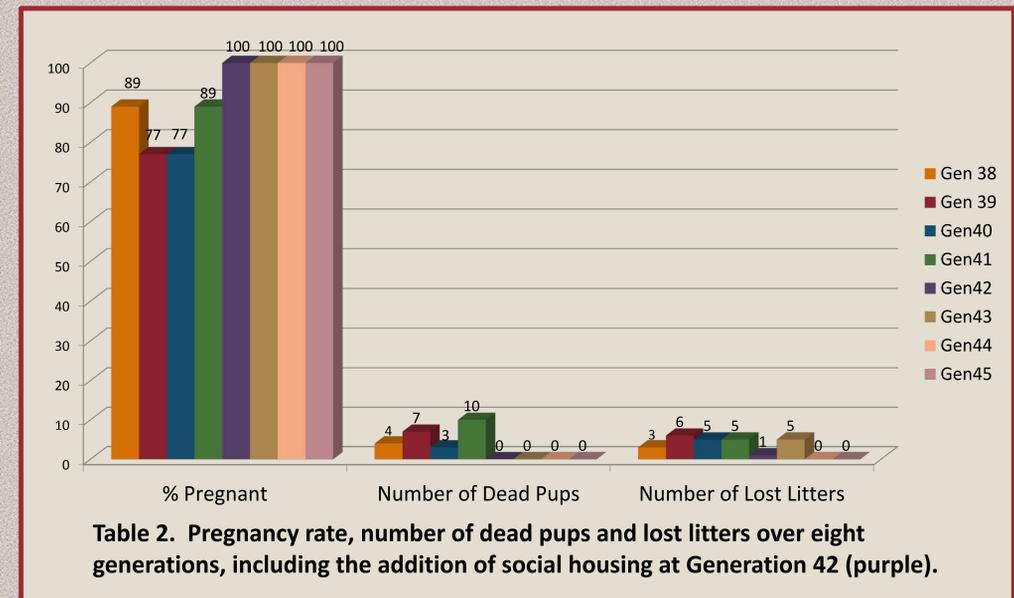
Study 2: Reducing Social Stress

Introduction:

In one colony, DB, the enrichment tube didn't show a marked increase in fertility and pup survival. Pregnancy rates were low, and pup survival was lower than necessary to sustain the colony. Action needed to be taken for colony survival. The mice were found to be healthy, so again, we looked at adding enrichment. The "Aunting" phenomenon was discussed in a Jackson Labs Webinar on colony management, and we decided to incorporate social housing for littering dams to take advantage of this behavior.

Materials and Methods:

This was a relatively simple form of enrichment to incorporate into our colony management system. We routinely set up trio matings, consisting of one male with litter mate females. After 16 days, the male is removed to avoid postpartum pregnancy, and, historically, females were placed in separate littering cages. For this enrichment, the pregnant females were left together in a single cage for littering. Having a cage mate appears to calm the animals and encourages them to care for each other's young.



Results:

Again, the results were immediate and dramatic, as seen in Table 2. Pregnancy rate, measured as percent of females that littered of those mated, rose from 77-89% to 100% when social housing was instituted at Generation 42 (purple). Losses in earlier generations may have been due to unrecognized abortions and resorptions following transfer to littering cages. An equally important result was the substantial drop in number of dead pups and lost litters (died before weaning). The litters lost in Generation 43 (brown) were during a time when the facility was experiencing disruption from construction noise and vibration. This type of social housing has become protocol in several of our poor-producing colonies.

References:

Harburger L, Nzerem C, Frick K 2007. Single Enrichment Variables Differentially Reduce Age-Related Memory Decline in Female Mice. *Behavioral Neuroscience* 121: 679-688.
 ILAR. 2011. *The Guide for the Care and Use of Laboratory Animals*, Eighth Edition
 Smith A, Corrow D 2005. Modifications to Husbandry and Housing Conditions of Laboratory Rodents for Improved Well-being. *ILAR Journal* 46:140-147.
 Van de Weerd, H, Baumans, V 1999. Evaluation of Environmental Enrichment for Laboratory Mice. *AWIC Bulletin* Vol. 9 No. 3-4.

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