

Appendix 1: Environmental Enrichment for Rodents

Introduction:

A major objective of the NIH Intramural Research Program (IRP) Animal Care and Use Program is to promote the humane care and use of animals in biomedical research. This guidance provides recommended best practices to facilitate environmental enrichment for rodents.

The Guide for the Care and Use of Laboratory Animals (Guide), promotes the humane care and use of laboratory animals and strives to enhance animal well-being, the quality of research, and the advancement of scientific knowledge that is relevant to both humans and animals.(1)

Environmental Enrichment Strategies:

For the purpose of this document, enrichment is defined as, “an increase in the complexity of the environment in which the animal lives, with the goal of enhancing the animal’s welfare”.(2) The *Guide* states that animal programs should address the behavioral, physiological, and physical needs of the species, stocks, or strains of animals maintained in the laboratory setting. (1)

In addition, AAALAC International recognizes environmental enrichment as an important method for improving the well-being of laboratory animal species through the provision of stimuli, structures, and resources that facilitate the expression of species-appropriate behaviors.(3)

Therefore, the overall goal of enrichment is to provide animals with opportunities to engage in species-typical behaviors and to promote psychological well-being through structural, social, and activity-based strategies. (4-6) A successful enrichment program should consider all aspects of a species’ natural behavior, including social organization, foraging behavior, and daily activity patterns. (7-9)

Common environmental enrichment and husbandry refinement strategies for rodents may include species-appropriate social, structural, handling, and manipulanda enrichment, (6, 8, 10, 11) as summarized in Table 1.

Table 1: Rodent Husbandry Refinements

Social Housing	Structure and Substrate
<ul style="list-style-type: none"> • Housed in compatible pairs or groups unless otherwise justified in the ASP or for clinical health concerns (e.g. aggression) 	<ul style="list-style-type: none"> • Paper nesting material (i.e., Nestlets® for mice), virgin pulp bedding, strips of paper fibers • Plastic or paper housing structures • Multi-level/climbing structures (e.g. Escape platforms, wheel, trapeze) • Foraging mix/treats
Manipulanda/Toys	Refinement Handling
<ul style="list-style-type: none"> • Plastic huts • Running wheels • Hide tubes • Gnawing devices (i.e., Nylabones) • Puzzle feeders 	<ul style="list-style-type: none"> • Minimize lifting mice by the base of the tail (e.g. cupping, tunnel handling) • Positive human interaction to reduce fear (e.g. frequent handling, tickling)

Summary:

Environmental enrichment strategies for rodents have been widely adopted across the NIH IRP, the United States, and Europe (5, 12-14) to address the welfare of rodents used in biomedical research. Standardized strategies have been successfully applied across a broad range of research settings and scientific disciplines without adversely affecting research outcomes. (13-15)

Consistent with these strategies, each NIH animal program should maintain a documented environmental enrichment plan for rodents and clearly describe the approaches used within the program. Environmental enrichment plans should be reviewed by the Institute/Center (IC) Animal Care and Use Committee (ACUC) on a regular basis. Any deviation from the IC's enrichment policy should be scientifically justified and approved in the Animal Study proposal (ASP).

To minimize variability across facilities and programs at the NIH, it is recommended that each program implement at least two environmental enrichment strategies for rodents. For example:

- Mice could have nesting material (e.g., Nestlet® Crink-I'Nest®) and a secondary enrichment strategy from Table 1 to be incorporated into the microenvironment.
- Rats could have a gnawing device and a secondary enrichment strategy from Table 1.

Programs that implement additional environmental enrichment strategies beyond this minimum must consider the potential introduction of research variables between animals' populations, experimental conditions, and facilities. (2, 15)

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