

Appendix 1: Environmental Enrichment of Rodents

Introduction

A major objective of the NIH Animal Care and Use Program is to promote the humane care and use of animals in biomedical research and this guidance serves as a set of best practices to help achieve that goal. *The Guide for the Care and Use of Laboratory Animals* (NRC, 2011), hereafter referred to as *The Guide*, is one of the primary references regarding the implementation and management of the NIH Animal Care and Use Program. The *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.

It is the intent of this document to establish best practices for enrichment programs for rodents on the NIH Campus.

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.’ Home cage enrichment may include housing animals in social groups; housing animals with structural or activity based cage supplementations or both. The end goal of enrichment is to provide the animals with the option and ability to engage in species typical behaviors and promote psychological well-being through the use of structural, social, or activity based opportunities. The *Guide* states that animal programs should address the behavioral, physiological, and physical needs of the species, stocks, or strains of animals held in the laboratory.

A successful enrichment program takes into account all aspects of a species’ natural behavior, including social organization, foraging behavior, and daily activity of the animal (Poole and Dawkins, 1999; Steward and Raje, 2001). The Association for Assessment and Accreditation of Laboratory Animal Care, International (AAALAC) has stated that environmental enrichment is an important method of improving the well-being of many laboratory animal species and may be accomplished by the provision of stimuli, structures, and resources that facilitate the expression of species-appropriate behaviors.

The primary enrichment strategies for rodents include:

1. Social housing – Rodents are pair or group housed unless the requirements of the research protocol or animal health concerns make this impossible. Adult males may require single housing due to aggression.
2. Structure and substrate – Paper nest building material (i.e. Nestlets[®] for mice) may be provided. This allows for the expression of nesting behaviors. Additional nesting materials, such as virgin pulp bedding or strips of paper fibers and/or plastic or paper housing structures to hide in are offered at the discretion of the facility or if specifically requested by the Investigator (eg. for some breeding females).
3. Manipulanda/toys – Devices such as plastic huts, running wheels, and Nylabones may be provided.

Environmental enrichment, should be provided in a consistent manner across the animal program. When discussing the humane care and use of animals, it is important to discuss a balance between animal well-being and the goals of the biomedical research at hand (Weed and Raber, 2005). According to *The Guide*, “enrichment programs should be reviewed by the IACUC, researchers, and veterinarian on a regular basis to ensure that they are beneficial to animal well-being and consistent with the goals of animal use.” (Guide, Page 53).

Concerns Surrounding Enrichment Supplementation

Concerns have been raised regarding the impact of non-systematic application of enrichments (supplements) on ongoing research programs (Hutchinson et al, 2005; Weed and Raber, 2005, Baumans, 2005). Currently there are two divergent opinions regarding the provision of supplements for in home cage use. The first is that enrichment supplementation enhances the welfare of laboratory housed animals and does not affect the standardization of laboratory environments nor significantly affect the research results obtained (Würbel and Garner, 2007; Würbel 2007; Wolfer et al, 2004). The second is that non-systematic application of home cage enhancements results in a lack of standardization and may affect the research data obtained in unknown and potentially detrimental ways (Benefiel et al. 2005, Tsai et al, 2003; von Praag et al 2000). The introduction of genetically modified animals and differential effects of enrichment has also been identified as a possible problematic area (Dennis, 2000; NRC 2011).

Consideration should also be given to the type of research and possible impact on the research, especially in the field of neuroscience (Fureix, 2016; Vega-Rivera, 2016).

Summary

Environmental enrichment strategies for rodents have been widely adopted across the NIH Intramural Research Program, the United States, and Europe (EU Council Directive, 2010/63/EU) to address the welfare of rodents used in biomedical research. Standardized strategies have been applied to a wide range of research situations with varying research goals without adverse results. All NIH programs should have an environmental enrichment plan for rodents used within their program. Enrichment plans should delineate the approach to be used within the program.

In order to minimize the impact of enrichment supplementation as a research variable between facilities and programs at the NIH, it is recommended that each program adopt the addition of nesting material (e.g. Nestlet[®]) to the microenvironment as the minimum requirement for both socially housed and individually housed mice and nesting material, a tube or a gnawing device for rats. Programs choosing to go above this minimum must consider the introduction of additional research variables between their animals and animals housed in different facilities and programs. Scientifically valid reasons for either enhancing or limiting the microenvironment should be provided to the IACUC during initial protocol review. In all situations, the decision regarding whether or not to enhance the microenvironment of rodents housed in the intramural program at NIH ultimately rests with the Principal Investigator and the protocol review process in each Institute/Center’s IACUC.

Approved – 12/11/13

Revised – 3/22/17

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