



Title	Environmental Enrichment, Social and Behavioral Management,
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## I. Policy

Central Michigan University complies with Public Health Service (PHS) Policy, as stated in the CMU Assurance statement to the PHS (Assurance), including the Guide for the Care and Use of Laboratory Animals (Guide). It is the policy of the Central Michigan University Animal Care and Use Program (ACUP) that the requirements and recommendations for social housing, social and behavioral management and environmental enrichment found in the Guide will be followed. All animals will be socially housed when appropriate for the species and provided appropriate environmental enrichment unless not doing so is scientifically justified in a protocol approved by the Institutional Animal Care and Use Committee (IACUC).

## II. Background

The Guide states the following with regard to the primary enclosure and social housing of animals used in research:

“All animals should be housed under conditions that provide sufficient space as well as supplementary structures and resources required to meet physical, physiologic, and behavioral needs. Environments that fail to meet the animals’ needs may result in abnormal brain development, physiologic dysfunction, and behavioral disorders (Garner 2005; van Praag et al. 2000; Würbel 2001) that may compromise both animal well-being and scientific validity. The primary enclosure or space may need to be enriched to prevent such effects. An appropriate housing space or enclosure should also account for the animals’ social needs. Social animals should be housed in stable pairs or groups of compatible individuals unless they must be housed alone for experimental reasons or because of social incompatibility (see also section on Behavioral and Social Management). Structural adjustments are frequently required for social housing (e.g., perches, visual barriers, refuges), and important resources (e.g., food, water, and shelter) should be provided in such a way that they cannot be monopolized by dominant animals.”

With regard to environmental enrichment, the Guide adds that:

“The primary aim of environmental enrichment is to enhance animal well-being by providing animals with sensory and motor stimulation, through structures and resources that facilitate the expression of species-typical behaviors and promote psychological well-being through physical exercise, manipulative activities, and cognitive challenges according to species-specific characteristics (NRC 1998a; Young 2003). “

### III. Procedures

The following procedures are meant to provide researchers and animal care staff with general guidance on the provision of enrichment. Each protocol should carefully consider species specific needs and experimental design in developing an appropriate enrichment plan. Researchers and animal care staff should contact the Attending Veterinarian, animal facility managers, animal care staff or the IACUC for assistance in developing species specific enrichment programs.

General recommendations for fish (may be applied to other aquatic animals as appropriate to the species):

- A. Natural behaviors should be known in order to provide the best enrichment type.
- B. Exhibit/housing considerations include:
  - 1. Periodic changes of lighting intensity
  - 2. Seasonal changes of light photoperiod and/or temperature
  - 3. Periodic changes in exhibit décor (changing out or rearranging rocks, plants, pvc, etc) Diet
  - 4. Feeding at different times of the day
  - 5. Feeding in different area
  - 6. Feeding different food items (frozen, freeze dried, etc)
  - 7. Offer food in natural settings (food put inside container for natural foraging/digging)
- C. Social Enrichment
  - 1. Mixing species for interaction
  - 2. Same species for natural behaviors (schooling fish housed with same species, breeding, etc.)
- D. Training
  - 1. Train to 'target' to monitor food consumption
  - 2. Train to 'target' to move fish to another enclosure.

General recommendations for pigeons (may be applied to other birds as appropriate to the species):

- A. Housing considerations:
  - 1. Group housing that allows for short flights should be considered.
    - a. Group housing for animals that have been singly housed long term may be contraindicated due to the potential for aggression.
    - b. If singly housed animals exhibit aggression towards their neighboring animals, group housing and group interaction/flight area use should either be carefully monitored or avoided.
    - c. The justification for singly housing birds should be described in an IACUC approved protocol or exception.
  - 2. Areas for birds to hide must be provided (visual barrier/refuge) when group housed.
  - 3. If birds must be individually housed a flight area/cage for the birds to exercise and interact with other birds should be provided. A water bath may be offered in this area.
- B. If birds must be individually caged:
  - 1. Cages must be large enough so birds can stretch and flap their wings.
  - 2. Multiple perches at different levels are recommended.

3. Solid flooring is recommended by some sources but may impact how quickly caging becomes soiled. Alternatively flooring with holes small enough to avoid potential entanglement/injury of birds feet but large enough to allow excrement to fall through should be considered.
  4. Small amounts of bedding can be used for foraging.
- C. Enrichment:
1. Hang items in the cage – mirrors, bells, bird toys
  2. Hide seeds, nuts and fruits for foraging
  3. Water bath- opportunity to play in the water (heated bulbs or other features may be needed to avoid birds becoming chilled from water baths)
  4. Provide group flight/exercise area

General recommendations for rats and mice (for other laboratory rodents refer to species-specific guidance):

- A. Housing considerations: Rats and mice must be socially housed unless experimental conditions or social incompatibility (e.g. aggression) require individual housing.
- B. If rats or mice must be individually caged, environmental enrichment must be provided unless experimental conditions justify withholding of enrichment.
- C. If enrichment is withheld from individually housed animals, these animals must be monitored carefully for signs of stereotypical behaviors.
- D. Enrichment:
  1. Novelty of enrichment should be a consideration; however, changing animals' environment too frequently may be stressful.
  2. Enrichment should provide animals with choices and/or a control over their environment, which allows them to better cope with environmental stressors (Newberry 1995).
  3. Examples include visual barriers and shelters for rodents to allow them to retreat in case of disturbances (Baumans 1997; Chmiel and Noonan 1996; Stauffacher 1992); and nesting material and deep bedding to allow mice to control their temperature and avoid cold stress during resting and sleeping (Gaskill et al. 2009; Gordon 1993, 2004).

Other considerations: Periodic review, training and minimization of variability

Enrichment programs should be reviewed on a regular basis to ensure that they are beneficial to animal well-being and consistent with the goals of animal use.

Personnel responsible for providing enrichment should receive training in the behavioral biology of the species they work with to appropriately monitor the effects of enrichment as well as identify the development of adverse or abnormal behaviors.

As stated in the Guide, some scientists have raised concerns that environmental enrichment may introduce experimental variability, adding not only diversity to the animals' behavior but also variation to their responses to experimental treatments (e.g., Bayne 2005; Eskola et al. 1999; Gärtner 1999; Tsai et al. 2003).

The Guide also states that "A systematic study in mice did not find evidence to support this viewpoint (Wolfer et al. 2004), indicating that housing conditions can be enriched without compromising the precision or reproducibility of experimental results. However, it has been shown that conditions resulting in higher-stress reactivity increase variation in experimental data (e.g., Macri et al. 2007). Because

adequate environmental enrichment may reduce anxiety and stress reactivity (Chapillon et al. 1999), it may also contribute to higher test sensitivity and reduced animal use (Baumans 1997).”

More recent studies have provided data supporting both viewpoints, that enrichment impacts behavioral and experimental variability or reduces/normalizes it (Bayne 2018, Bailoo et al. 2018, Akhund-Zade et al. 2019). While the experimental variables of many of these studies do not allow for a direct comparison of the results, it is likely (based on the results of these studies) that the type, timing and consistency of enrichment are important factors in minimizing variation. Impacts of enrichment should be carefully monitored by researchers to ensure that experimental outcomes are not impacted.