

Experimental Animal Welfare Efforts

—Environmental enrichment (focusing on rodents)—

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Animal welfare in experimental animals

At home and abroad, there is a demand for consideration of the welfare of experimental animals. Animal welfare means considering the 3Rs(Refinement, Reduction, Replacement) .

Eliminate animal suffering (housing, experimental procedures, psychological stress, handling of animals) to the extent that it does not affect research.

Consider **well-being*** as much as possible while they are alive.

* Well-being means that animals are able to feel at ease and express the inherent characteristics of the animal species in terms of their behavior.



Definition of environmental enrichment

“The primary purpose of environmental enrichment is to **enhance animal well-being**. Environmental enrichment provides stimuli, structures and resources that facilitate the expression of species-specific behaviors. This can be achieved by providing

(ILAR's guide 8th edition)

“Environmental enrichment should provide stimuli to facilitate the expression of species-appropriate behavioral and psychological activities in a low-stimulus environment.”

Reinhardt (2002)



Classification of environmental enrichment

Sociality

- Reproduce the original “sociality” of animals by forming groups and coming into contact with other animals.
- Acclimatization to humans
(example)
Group housing, physical, visual and social interaction with animals in adjacent cages
Acclimatization to humans/improvement of affinity
Acclimatization to rearing environment/experiment

Space

- A space that considers animal characteristics such as climbing trees and swimming
- In addition to the width and height, the content of the space is enhanced.
(example)
Cage size that allows free movement
Standing up and vertical movement possible
Cage structure that allows various movements
Hideout, perch, hammock

Cognition

- Environment where the animal can operate by itself, such as complex devices and playground equipment
Requires problem-solving
- Stimulates animal intelligence
(example)
Food cannot be obtained without performing complicated operations.

Foraging

- Eating in the wild can be difficult!
- Change the type and method of feeding
(example)
Use a puzzle-like device to hide and search for food

Sensation

- Not fix the breeding environment, but give stimulation to “sounds” and “smells”
- Stimulate the five senses and change the environment
(example)
Toys and mirrors that match the animal species
Diversification of food and extended contact time
Nesting materials, music, and images

It is necessary to provide a combination according to the characteristics of the animal species! !

Diverse examples of environmental enrichment by species

<Mouse>

- Prefers materials that can be used as **nest materials** (optimal for lineage maintenance and breeding)
- Prefers to explore **plastic pipes** (climb > hideout, sleeping place)
- Prefers running wheels (running wheels) and uses them voluntarily

<Rat>

- Appropriately sized wooden tools: no danger, encourage **biting** (wood chips, wooden balls > acrylic plates, PVC pipes)
- Tend to prefer **rubbing against walls and high places (lookouts)**

<Rabbit>

- Installation of structures for the purpose of hiding and searching
- Box with chips (rest area)
- Wooden bites and tooth sharpening sticks



Types of environmental enrichment in rodents



Chocolate O's
Certified



Timothy Hay Bulk Packed
Certified



Mouse Fort
Certified



Rat Tunnels
Certified



Rat Tunnel
Stainless Steel End Caps
Certified



Rest Stops
Certified



Bio-Huts for Rats
Certified



Nutra-Gel
Complete Nutrition



Electro-Gel
Electrolyte Replenisher



Nesting Sheets
Certified



Safe Harbor Mouse Retreat
Certified



Timothy Hay Mini Bales
Certified



Pure-Water Gel
Total Hydration



Pyramid Feeder
Certified



Rainbow Foraging Bits
Certified



Wood Gnawing Blocks
Certified

1. Ingenuity of feed: nutritional supplements, roughage
2. Playground equipment/forage search device: ball, rope
3. Shelter (evacuation site): dome, tube
4. Privacy: enclosures, bulkheads, visual barriers
5. Resting place: high shelf, resting board
6. Nesting materials: paper, cloth, wood shavings
7. Pieces of wood: chewing sticks, markings

Examples of laboratory animal welfare initiatives at the Institute of Longevity

Nesting materials

Care Feeds



Happy Mat



Special breeding feed

CMF Sprouts



Enrichment

Biotunnel



Nest



Wood chips



Mouse swing



Running wheel



When mouse breeding is not going well, or mice fight, etc., it may be improved by adding **enrichment or nesting materials**.

For details, please contact the Experimental Animal Management Office.

Quoted from the text of the animal experiment seminar



Examples of environmental enrichment

mouse



rat



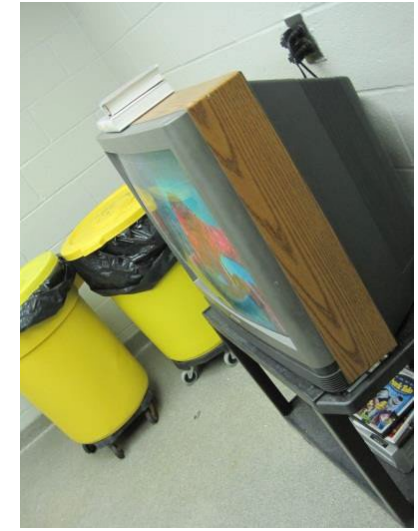
Examples of Environmental Enrichment at U.S. Animal Experimental Facilities



Cynomolgus monkey breeding room



Baboon Keeping Room



showing video to baboons



rabbit breeding room



pig breeding room



nutritional supplement



Effects of environmental enrichment

Environmental enrichment acts as a stress buffer.



Fighting was induced by the presence of nesting material in aggressive strains of mice. But adding shelter to this cage averted the struggle.

Environmental modification and agonistic behavior in NIH/S male mice: nest in material enhances fighting but shelters prevent it. *Kaliste EK et al. Comp.Med.56:202-8.2006*

Environmental enrichment is immunostimulating.



Environmental enrichment has anticancer effects.



Addition of environmental enrichment reduced the tumor size of tumor-bearing mice.

Environmental and Genetic Activation of a Brain-Adipocyte BDNF/Leptin Axis Causes Cancer Remission and Inhibition. *Cao L et al. Cell 142:52-64. 2010*

1. Acclimatization is efficient
2. Reduced fighting between animals
3. Mischief of the automatic water nozzle is reduced
4. Relatively easy to handle



Handling with Consideration for Laboratory Animal Welfare

Mouse handling posters

To support the adoption of non-aversive methods for picking up mice, we have produced an A2-sized poster for display in animal facilities and laboratories.



New methods to handle mice - time for a change

John Waters, Kelly Gouveia and Jane L. Hurst, Mammalian Behaviour and Evolution Group, University of Liverpool, Leahurst Campus, Neston CH64 7TE. The way that you pick up laboratory mice influences their stress, longer-term anxiety and reliability in scientific testing. Picking up mice by the tail induced negative responses¹⁻³. In contrast, picking them up in a tunnel, or cupping them on the hand, considerably reduces stress and anxiety, and results in animals that are much more willing to interact with you voluntarily¹⁻³. Below are simple tips for implementing these methods. Your choice should be compatible with your local biosecurity rules.

For further details and advice, see our free-to-view video tutorial at www.nc3rs.org.uk/mouse-handling-tutorial

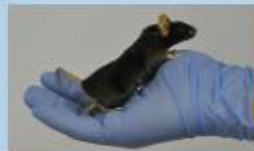
Tunnel handling

- Guide mouse into tunnel with free hand
- Lift mouse inside tunnel
- Remove by tipping out backwards, with end of tunnel just above surface
- Mice habituate very quickly to tunnels
- Ideal for less experienced handlers
- Minimal risk of being bitten
- Abnormal behaviour easily spotted



Cup handling

- Scoop mouse onto one or both palms
- Lift hand(s) clear of cage
- Mouse sits on the hand without restraint
- A single hand is sufficient once mice are familiar with this method
- Mice slower to habituate to cup handling
- Needs more skill to prevent mice jumping, but can improve animal-handler bond



Combined tunnel to cup handling

- Pick mouse up in a tunnel
- Tip backwards onto open hand
- Mouse should stay willingly on the hand



Tips for good handling

- Don't be hesitant
- Use cage side and free hand to guide mouse quickly into the tunnel - do not chase the mouse with the tunnel
- Do not wait for the mouse to enter voluntarily, actively guide it in
- With good technique, mouse will go straight in - practice makes perfect!
- Mice familiar with tunnels enter more readily
- Provide mice with a tunnel in their home cage if possible?
- Mice stay in the tunnel when lifted up, but cover tunnel ends to move animals safely over a distance
- Tip mice out backwards and do not shake them out



Restraint for procedures

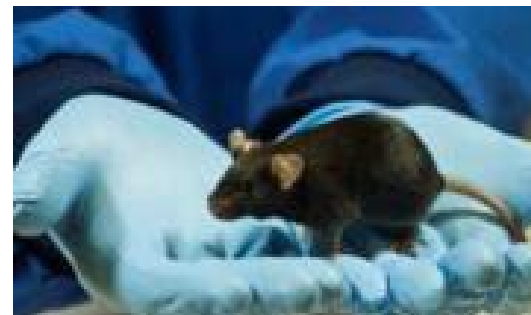
- Capturing and picking up mice by the tail should be avoided where possible
- Once picked up, mice can be restrained by the tail, e.g. for sexing
- They can also be restrained by scruffing as needed for scientific procedures
- Restraint by the tail or scruff does not reverse the positive effects of tunnel and cup handling¹



Taming anxiety in laboratory mice Nature Methods 7, 825-826 (2010)

Abstract

Routine laboratory animal handling has profound effects on their anxiety and stress responses, but little is known about the impact of handling method. We found that picking up mice by the tail induced aversion and high anxiety, whereas use of tunnels or open hand led to voluntary approach, low anxiety and acceptance of physical restraint. Using the latter methods, one can minimize a widespread source of anxiety in laboratory mice.



Points to note when introducing environmental enrichment

1. Is it suitable for the target animal?

- Does not cause sudden environmental changes
- Do not cause fighting or increase the superiority (individual difference) between individuals
- Consideration not to be monopolized by a dominant individual
- No effect on sight, hearing, smell, and touch
- Some objects (structures) may be harmful (marbles are stressful for mice)

2. Is it safe for animals and caretakers?

- Durable
- Not cause injury
- No animal health problems (digestion, allergies, etc.)

3. Is it easy to clean and disinfect?

- Easy to clean
- Sterilization and disinfection by heating and chemicals are possible

4. Will it affect research and observation?

- Does not interfere with daily observation of animals
- Does not cause changes in palatability
- No effect on drug absorption/excretion

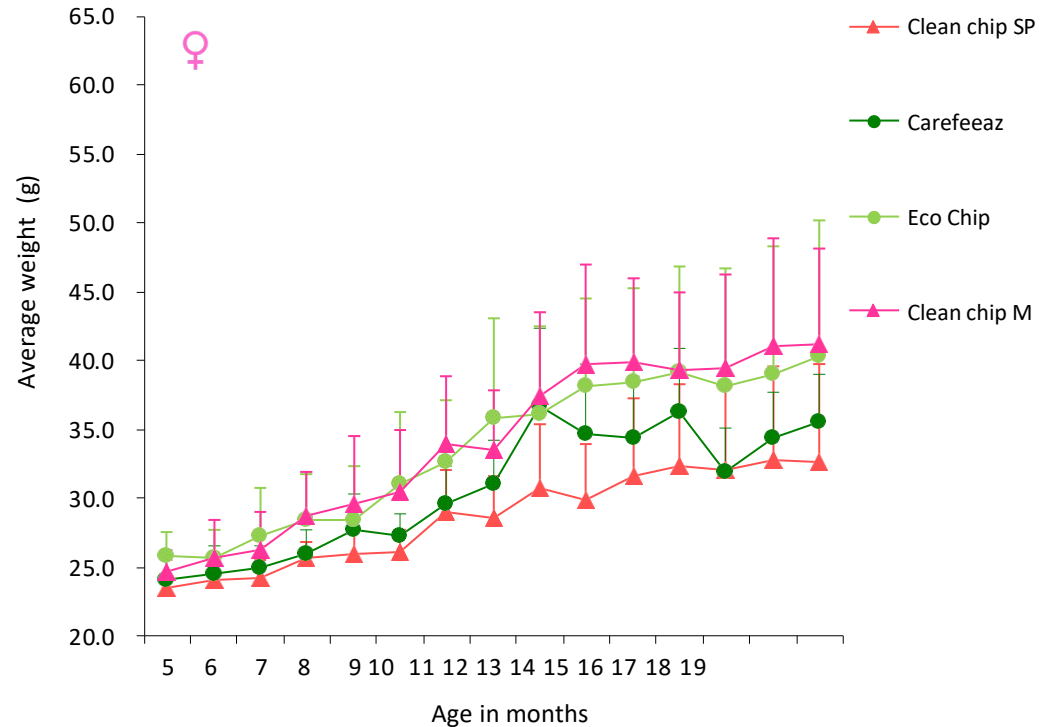
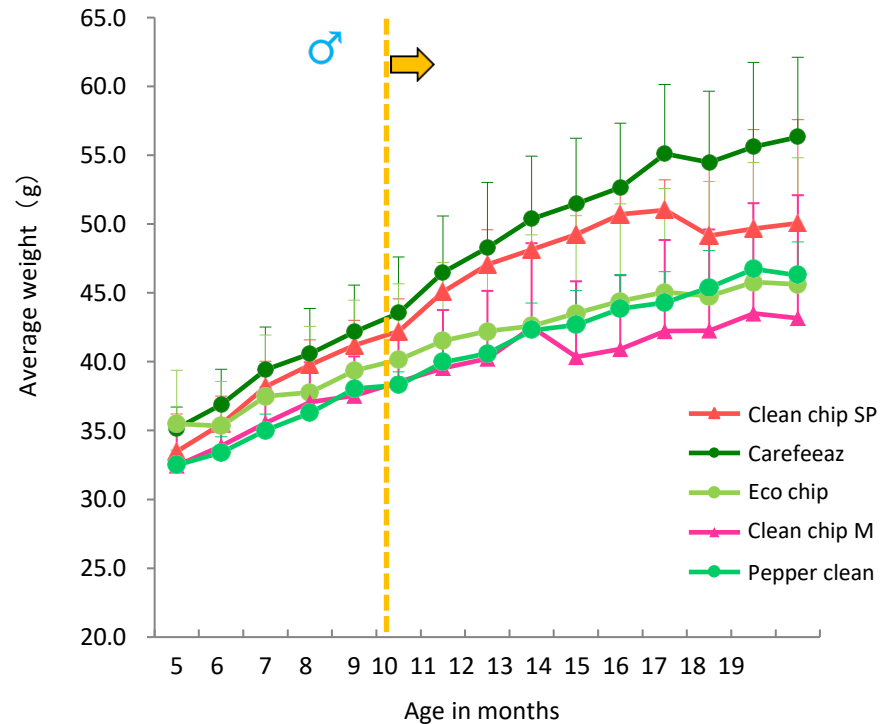
5. Is the installation method appropriate?

- Verify long-term interest (novel effects disappear rapidly), rotation
- Easiness of installation location and detachment

6. Providing animal breeding and training for animal breeders



Body weight change due to different bedding materials using B6N mice



- Different bedding types have different rates of weight gain
- Males and females have different tendencies

➡ Be careful when bedding is the main nesting material ! ?



Summary

1. Experimental animals have different characteristics depending on their species and strains, so it is necessary to thoroughly consider **environmental enrichment**.
2. Experimental animals are subject to stress due to experimental treatments, so care should be taken for their **well-being** to the extent that experimental results are not affected.
3. Observe animals health every day and keep a record of your observations.

