Policy for Housing and Environmental Enrichment for Rodents

Preamble: Experimental animals were traditionally kept in caging which provided little or no social or physical stimulation. The use of such caging was justified on the basis of reduction of disease spread, ease of sanitation, prevention of fights between animals, easy recognition of illness through measuring food and water intake, etc. However, at the time, little consideration was given to the behavioural and psychological well-being or the stress induced by social isolation and physical deprivation. It is recognized now, that the well-being of animals is greatly improved if they are provided with opportunities for interaction with each other and their environment. Furthermore, there is an increasing volume of literature denoting the deleterious effects of impoverished environments on experimental results. Although the term "environmental enrichment" is used to describe efforts aimed at improving the living conditions for animals, the move is really from a very impoverished environment to a less impoverished environment.
Another approach to evaluating well-being is to use the Five Freedoms of the UK Farm Animal Welfare Council. These freedoms were defined to give guidance to farmers on the goals of husbandry. However, the freedoms are easily adapted to other animals and have been accepted by various groups including the World Veterinary Association and Humane Societies.

The five freedoms are:

- freedom from hunger and thirst (by ready access to fresh water and a diet to maintain full health and vigor)
- freedom from discomfort (by providing an appropriate environment including shelter and a comfortable resting area)
- freedom from pain, injury and disease (by prevention or rapid diagnosis and treatment)
- freedom to express normal behaviour (by providing sufficient space, proper facilities and company of the animal's own kind)
- freedom from fear and distress (by ensuring conditions and treatment which avoid mental suffering)

We can assume, given our present knowledge, that the health, nutrition and general environment needs of the common laboratory animal species are being met in present day laboratory animal facilities. The major challenge for us is to provide them with social and physical opportunities to live and behave in a normal manner. To do that we must have some knowledge of what a particular animal needs based on understanding their preferences. All animals require social interactions although for some this interaction is intermittent and occurs only at breeding times. Most wild animals occupy their days in the search for food and water. The threat of predation is a fact of life for many small animals, including those in the laboratory where we are the predators. To be frightened without having any means of protecting yourself is a stressful experience. Lack of space

or structure to exercise or play, in the case of young animals, is detrimental to bone and muscle development and maintenance.

The major factors to be considered then are:

- Opportunities to socialize or not
- Opportunities to occupy time during waking hours
- Opportunities to hide

Cage equipment, nesting material, etc., allows the animal to interact with and in some cases manipulate their environment. The equipment or material in the cage should be appropriate for the animal's behavioural needs. Animals are sometimes given toys to play with but the toys should have some relevance to the animal or it will soon be neglected. Some animals, e.g., rats, may not like new toys, especially if they have no apparent function for the animal and the toy may be buried. The unpredictability of another animal may provide the majority of the diversion required to prevent the development of stereotypies that often develop when there is nothing to do. Rats have been shown to work harder to gain access to another rat than to gain access to their favorite toy.

Exploratory behaviour is an important component of the daily routine for many young animals, particularly rodents. This activity is often studied in rats and it is recognized that there are clear behavioural differences between rats that have had the opportunity to explore, for example, in a complex environment and those that have been reared in a simple environment. Rats that have been reared in the standard rat cage will stand up and look out when the top is removed. They will rarely attempt to leave the cage. On the other hand, rats that have lived in a complex environment will take the opportunity to explore the room if the cage is left open.

Most laboratory animals appreciate a place to hide, whether it be from cage mates, people or unexpected noises. Even within gregarious species, individuals may require a place to get away. Thus, where possible, animals should have a place within the cage where they feel safe. This may be a dark corner or it may be a sight barrier (e.g. tubes, overturned containers), which allows them to look for the cause of their alarm without revealing themselves. Unexpected noises are common in animal facilities and may be startling to animals. The natural tendency for the prey species is to hide while they try to determine the source of the noise. Large human figures peering into cages may also be frightening, causing the animals to seek refuge. If there is nowhere safe to hide, the animals will be stressed.

Space for exercise is important, particularly in young animals. Animals like to run or hop and this is important for bone and muscle development. There should be structures within the space to allow climbing, stretching, swinging, etc. Even relatively small structures within a cage will be used for exploration. Mice are often seen clinging upside-down to the food hopper.

The main food staple for laboratory rats is ordinarily a commercial high quality pelleted diet fed ad libitum. Hard pellets usually provide for sufficient gnawing. ***Natural food items, however, such as carrots, grain/seeds, and/or pieces of soft wood, are more species-appropriate items for gnawing.*** Rats should always have free access to them.

Wooden gnawing blocks are attractive enrichment objects (Chmiel and Noonan, 1996) that not only reduce the incidence of stereotypic chewing of metal cage bars (Orok-Edem and Key, 1994) and make the animals less timid (Eskola and Kaliste-Korhonen, 1998) but are available with certificates of analysis, a particularly important aspect for toxicological studies (Robertson, 1999). Rats "want" to forage (cf., Neuringer, 1969), and they can easily be induced to "work" for their food by soldering metal plates over their food hoppers, so that only a small segment of the original area remains available. This method of "food restriction" is preferable to giving less food to avoid obesity. Rather than rapidly eating a reduced ration and feeling hungry for long periods, the animals work harder for their food, which enables them to burn more calories and eat throughout the day. This reduces the incidence of obesity and its associated disorders and also encourages more "natural" behavior patterns, both of which improve welfare (Wrightson and Dickson, 1999).

In order to provide rats a sense of security and options of breaking visual contact with each other during agonistic conflicts, it is recommended to add vertical barriers (cf., Anzaldo et al., 1994) and/or tubes - made of PVC or aspen wood (Mering, 2000) - in their cages. This offers the animals additional wall contact, tactile comfort, escape routes, and areas for exploration, thereby increasing cage complexity and the usable floor space of the cage. Evidence suggests that a more complex housing environment - in sharp contrast to the barren cage - buffers anxiety responses to potential stressors (Levine, 1985). ***A well-designed cage provides a distinctive sheltered nest area away from the feeding location.*** Rats with access to an appropriate shelter are more explorative and less timid than those in barren cages (Townsend, 1997). Nest-boxes of opaque or semi-opaque materials are particularly suitable shelters (Manser et al., 1998). Ideally, rats should always have access to one cage section that is covered with a black perspex screen serving as dark-and-sheltered sleeping and hiding area and another section serving as living area (Figures 4; cf., Dickson and Wrightson, 1999). The living area section should be covered with a wire lid for gymnastics.

It should go without saying that solid floors are much more appropriate for the feet of rats than wire floors, which impact the feet in a biologically abnormal manner (Grover-Johnson and Spencer, 1981) and may cause discomfort, pressure sores, and pain. They may also cause chilling even in a warm room. While rats housed on grid or mesh floors tend to pile up in heaps when resting, rats with access to solid flooring spread out on the bedding (Dickson and Wrightson, 1999). Under experimental conditions, rats are prepared to make considerable efforts to reach a solid floor when they wish to rest. Preference testing revealed that the animals chose to dwell on solid floors rather than grids, regardless of previous housing experience. Thus ***there is ground for suggesting that laboratory rats be housed on solid rather then grid floors, because solid floor housing improves their welfare*** (Manser et al., 1995; Manser et al., 1996; Stauffacher, 1996). The *Guide for the Care and Use of Laboratory Animals* aptly recommends “solid-bottom caging, with [emphasis added] bedding ... for rodents” (National Research Council, 1996, p. 24). As a warning however, it must be pointed out that on solid PVC (polyvinyl chloride) floors the claws of rats may "over-grow" because the surface is not abrasive. If this happens, the claws must be clipped or the animal will experience

considerable discomfort. The widely used concept of housing rats on one type of cage flooring should be abandoned and replaced by a cage concept with different types of flooring - and bedding - to enable the animals to express a more complete behavioral repertoire (van de Weerd et al., 1996; Dickson and Wrightson, 1999).
It is impossible to fully satisfy the instinctive need for digging in caged rats. Dust-free woodchip (preferably irradiated) bedding is a good compromise solution that allows the animals not only to engage in quasi-digging maneuvers but also to forage, i.e., search for food particles. ***Woodchips*** - unlike sawdust - ***and corn-cob are the preferred bedding for rats*** (Blom et al., 1995; Patterson-Kane et al., 2001) ***and should be regarded as a basic, inexpensive means of environmental enrichment.*** The bedding also absorbs urine and moisture from feces. Regularly changed bedding is the best guarantee of a hygienic cage environment.

Taking various studies and welfare policies into account, Laurentian University has put together a minimum standard for housing rodents which is as follows:

1. All rodents are to be maintained on solid floor see through shoe box cages that are size appropriate for the size and number of animals. See SOP for rat and mice densities.
2. The bedding should be of a type and amount that the animal facility establishes.
3. Breeding rodents are required to have appropriate nesting material in the cages.
4. The number of cages per room will be limited by the ventilation capacities of each room and this may change from season to season. The director of the facility will give researchers this upper limit which must be abided by.
5. The lighting in each room will be periodically measured and kept within required limits.
6. A minimum for environmental enrichment will consist of the following: social interaction is important and rodents must always be housed with another co-habitant unless this can be substantiated, aside for bedding and proper space, there must be a minimum of one hiding place as well as at least one item to chew or interact with.

It should be noted that use of animals from one research protocol to another is strongly discouraged and requires peer review for scientific substantiation. This is definitely not suggested in the situation where animals are part of an invasive level C or higher. Animals cannot be held after completion of a research protocol and this timeline needs to be clearly defined in the initial AUP.

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