

Animal Source

PSU Animal Resource Program

Effective Environmental Enrichment for Rodents

Environmental enrichment is a familiar but somewhat vague term to most people who work with laboratory animals. It is usually understood to mean adding something to the standard housing environment in an effort to enhance the animal's well being. But what are we really trying to accomplish with environmental enrichment and how can its effectiveness be measured?

In an effort to clarify the issue, Leach (2) has outlined four specific goals of environmental enrichment that investigators can use as a guide in determining what may actually improve an animal's well being.

1. The object (or other alteration) added to the standard environment should result in an increase in positive normal behaviors.
2. The occurrence of abnormal or maladaptive behavior (i.e., stereotypies) should decrease.
3. The object should encourage the animal to fully use its environment.
4. The object should improve the animal's ability to successfully cope with captivity.

Methods or objects that meet one or more of these goals qualify as environmental enrichment. Objects that don't are probably not worth using. In other words, supplying toys or objects that have no relevance to the animal's normal behavior is not viewed as enrichment beyond an initial novelty effect. Unless regularly changed, the novelty will quickly wear off and the object will have no effect at all.

Measuring the effectiveness of environmental enrichment using the goals listed above primarily involves evaluating changes in behavior. Several studies have attempted to do this and provide objective criteria for what works and what doesn't in rodent enrichment. The following discussion outlines successful enrichment strategies that may be easily incorporated into current laboratory housing.

Group or pair housing

Group or pair housing is the most desirable enrichment method for all social species (4). It provides social interaction and the opportunity for animals to express many normal behaviors. Stable pairs or groups of animals generally exhibit fewer abnormal behaviors and signs of stress than individually housed animals. However, there are occasions when aggressive behavior or experimental design makes it impossible to group house animals. Other forms of enrichment should be provided to these animals.

Continued on page 2

Volume 2, Issue 4

Fall 2004

*Visit the ARP
website at
www.research.psu.edu/arp
for answers to your
animal use questions*

Inside this issue:

*Hantavirus in a
Graduate Student* 2

*ALF Break-In at
University of Iowa* 3

Hantavirus Pulmonary Syndrome in a Graduate Student

A wildlife sciences graduate student in Blacksburg, VA was diagnosed with Hantavirus pulmonary syndrome (HPS) in July 2004. The thirty-two year old man died from the disease after a three-day hospital stay. HPS is a rare cardiopulmonary disease caused by viruses of the genus *Hantavirus*. Several wild rodent species are natural reservoirs for these viruses. Transmission to humans occurs by direct contact with rodents or their excreta or by inhalation of aerosolized material containing viral particles.

The deceased man had spent the previous month trapping small mammals for study and handling mice (*Peromyscus* spp.) daily. According to coworkers, none of the students in his group wore gloves while handling the rodents or washed their hands after handling rodents. The students also received frequent bites on their hands while working with the animals.

HPS was first identified in the southwestern United States in 1993. Since that time, HPS has been reported in 31 states, including Pennsylvania, with a fatality rate of 37%. The CDC recommends that anyone handling wild rodents or their nests should wear disposable gloves and wash their hands immediately afterwards. For more information go to <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5346a3.htm>.



Enrichment, continued from page 1

Nesting Material

Several studies have shown that the addition of nesting material such as Nestlets (Ancare, Bellmore, New York) or Alpha-Nest (Shepherd Specialty Papers, Inc., Kalamazoo, Michigan) to rodent cages is a highly effective form of enrichment (3,5). Nest building is an important activity not only for breeding females who construct nests for their offspring, but also for non-breeding rodents (including males). Rodents will work for access to nesting material and prefer it to solid shelters. It is presumed that nests make it easier for rodents to maintain body temperature and provide shelter from external disturbances such as high light intensities or aggressive cagemates. Nesting material in the cage enables rodents to control their environment and alter the structure of their habitat to suite their needs, both important aspects of reducing stress.

Mice provided with nesting material have increased body weights and decreased food consumption compared to mice housed without nesting material (3). Adding nesting material to mouse cages does not lead to alterations in behavioral or physiological parameters and transferring nesting material at cage cleaning was shown to reduce aggression in group housed male mice (3). However, the use of nesting material did not affect aggressive behavior in male mice over the long term.

Nestboxes and Other Solid Structures

The addition of nestboxes, tubes, or platforms provides shelter but can also increase exploratory and locomotor opportunities for rodents. Although rodents will use these structures, preference tests have indicated that nesting material is preferred over a nestbox (3). In addition, aggressive behavior in male mice sometimes increases if these structures are added to the cage (3,4). Presumably the structure becomes a desirable territory that the dominant mouse feels compelled to defend from his cagemates.

Autoclavable polycarbonate running wheels are available for use in standard rodent caging and are often heavily used by many rodent species. Although researchers may purchase wheels for their own animals, their high cost makes it difficult for animal facilities to supply all rodents with them.

Interestingly, the use of structures and platforms in rodent cages changes the animal's reactions to many standard behavioral tests. For example, animals housed under these conditions may show increased activity in open field and exploration tests and the elevated plus maze in addition to changes in time budget (i.e., a measure of how animals spend their time) (3).

Continued on page 3

Enrichment, continued from page 2

Food Treats and Gnawing Devices

Although food treats are often recommended for rabbits and other large laboratory animals most laboratory rodents are not provided any food source other than their standard diet. Food items from grocery or pet stores may be contaminated with wild rodent urine or droppings that could potentially introduce pathogenic agents into the colony and are strongly discouraged. However, a few companies sell treats and special diets specifically manufactured for rodents. Treats and other food items are often preferred over the regularly supplied food and could lead to variability in the composition and nutritional balance of the diet.

Mice and rats are sometimes given nylon or polyurethane bones (Nylabones, Gumabones; Bio-Serv®, Frenchtown, NJ) to allow the expression of gnawing and chewing behavior. These bones are nontoxic and cage washer and autoclave safe. The use of wood or material of uncertain composition is discouraged because of the difficulty in sanitation and possible toxic effects.

Watson (5) showed that some rats gnawed on the nylon bones extensively while others primarily moved the bones around their cage. The use of these bones had no effect on commonly tested variables (i.e., biochemical and hematologic values) and did not cause gastrointestinal tract lesions.

The enrichment tools discussed in this article are easy to implement, cost-efficient to use and meet the goals of successful environmental enrichment for rodents. Further information on environmental enrichment may be obtained from the references listed below or by contacting the ARP veterinarians.

References:

1. Leach M, Ambrose N, Bowell V, Morton D. The development of a new form of mouse cage enrichment. *Journal of Applied Animal Welfare Science* 2000; 3: 81-91.
2. Marashi V, Barnekow A, Ossendorf E, Sachser N. Effects of different forms of environmental enrichment on behavioral, endocrinological and immunological parameters in male mice. *Horm Behav.* 2003 Feb; 43(2): 281-92.
3. Olsson I, Dahlborn K. Improving housing conditions for laboratory mice: a review of 'environmental enrichment'. *Laboratory Animals* 2002; 36: 243-270.
4. Stewart K. Development of an environmental enrichment program utilizing simple strategies. *Animal Welfare Information Center Bulletin*, 2004 Summer, 12(1-2):1-7.
5. Watson D. Evaluation of inanimate objects on commonly monitored variables in preclinical safety studies for mice and rats. *Laboratory Animal Science* 1993 August; 43(4): 378-380.



ALF Claims Responsibility for Iowa Rodent Lab Break-In

The Animal Liberation Front (ALF) has claimed responsibility for stealing 88 mice and 313 rats from a University of Iowa animal facility last month. The vandals destroyed computers and lab equipment during the break-in and drenched offices and labs with hydrochloric acid. Seven faculty members of the psychology department were named as primary targets in an email letter later sent to the news media by ALF. The letter included details of the faculty member's research and listed personal information, including names of spouses, cell phone numbers and personal e-mail accounts.

A videotape of the break-in was sent to the local news media by ALF and reportedly showed the vandals using key-cards to gain access to the locked animal facility and laboratories. The FBI is investigating the crime and the University of Iowa has offered a \$10,000 reward for information leading to the arrest of the vandals.

Continued on page 4

Animal Resource Program

101 Centralized Biological
Laboratory
Pennsylvania State University
University Park, PA 16802

(814) 865-1495
Fax: (814) 865-3685



The Animal Resource Program (ARP) is committed to providing PSU faculty, staff and students with high quality, cost-effective research animal resources. In addition to suitable housing facilities and animal husbandry services for animals used in biomedical research, ARP provides veterinary and diagnostic services, personnel training and expertise in laboratory animal technology and medicine. ARP veterinarians are also available to participate in collaborative research projects with PSU investigators. Areas of interest include animal behavior and welfare, infectious disease, and pathology.

ALF Break-In, continued from page 3

Although violent activity and infiltration of research organizations by animal rights groups has been occurring in the United States for years, the focus has historically been on animal species such as primates and dogs. However, these groups have recently shifted their attention to research involving mice and rats. For example, People for the Ethical Treatment of Animals (PETA) has planted undercover operatives in a University of North Carolina at Chapel Hill animal facility twice within the last 2 years. Investigators using rodents can no longer consider themselves immune to attack from animal rights organizations and are reminded to be alert and report any suspicious individuals or activity in laboratories or animal facilities.

Further information on the events described above and how researchers may protect themselves from animal rights infiltrators may be found at the following websites:

University of Iowa break-in: <http://www.press-citizen.com/apps/pbcs.dll/article?AID=/20041125/NEWS01/411250308/1079>

University of North Carolina PETA infiltration: <http://www.wral.com/news/1405795/detail.html>

Screening potential employees: http://www.research.psu.edu/arp/Copy_of_Summer2004ARPnewsletter.pdf