

Animal Source



PSU Animal Resource Program

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Maintaining Body Temperature in Rodents During Anesthesia

General anesthesia causes a drop in core body temperature by disrupting normal thermoregulatory mechanisms. The drop in body temperature occurs more rapidly in small rodents due to their high body surface area to body mass ratio. Hypothermia during anesthesia has been shown to lead to cardiac arrhythmias, increased susceptibility to infection, prolonged anesthetic recovery time, increased potential for anesthetic toxicity and death.

Consequently, it is recommended that supplemental heat be provided to maintain body temperature during general anesthesia. A study by DK Taylor in the September 2007 issue of *JAALAS* looked at two types of heating devices and compared the ability of these devices to maintain body temperature in mice and rats during one hour of isoflurane anesthesia. In this study Taylor compared a circulating hot-water blanket versus a microwaveable heating pad marketed for warming pet beds. In addition, a control group of mice and rats were provided no supplemental heat during anesthesia.

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What's wrong with this mouse?



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Handling Mice Housed in Microisolator Cage Systems

The majority of mice at PSU are housed in microisolator caging, either static microisolator boxes or ventilated rack systems. Microisolator cage systems provide mice with a controlled environment that minimizes the risk for spread of infectious agents between cages. Specific handling techniques must be used to ensure that these systems are effective.

The main points to remember when working with microisolator caging are:

- Each cage is its own microenvironment and should receive minimal exposure to the room environment.
- Cages should be opened within a functioning ventilated hood.
- Personnel should only handle animals with disinfected gloved hands.

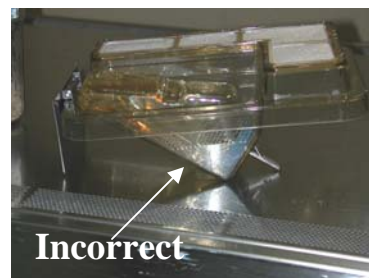
A step-wise summary of correct microisolator technique follows:

1. Turn on the changing hood or biosafety cabinet fan prior to starting work. Wear clean gloves and a long sleeved lab coat or gown. Disinfect the interior hood surfaces with disinfectant solution (e.g., MB 10 or Quat PV15) and prepare the equipment you will need in the hood.

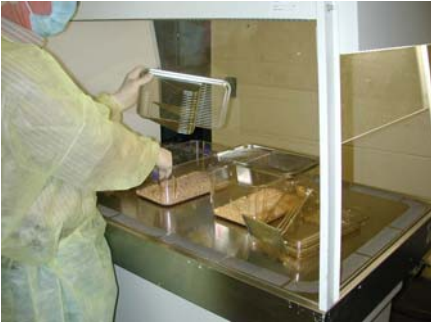


2. To open a mouse cage, set it inside the hood on the solid stainless steel work area. Do not work on top of or otherwise cover the airflow grate. Remove the filter top lid and place it, top down, next to the cage. Place the water bottle tip up next to the cage.

3. Do not place the filter top bottom down or let the sipper tube touch the hood surface.



4. Spray your gloved hands with disinfectant prior to touching the interior parts of the cage.



5. Lift the wire cage lid to remove mice. The lid can be placed sideways on top of the cage if desired. Do not set the wire lid on the hood surface.

6. Handle mice with gloved hands coated with disinfectant.

- Reverse procedures to replace the cage lid, filter top and water bottle.
- Spray hands with disinfectant before touching the interior surfaces of *each cage*.
- When finished working, wipe the hood interior surfaces with disinfectant followed by water moistened paper towels.
- Turn off the hood blower and lights.



Maintaining Body Temperature; continued from page 1.

Previous studies have led to recommendations that heating devices used for anesthetized animals not exceed a surface temperature of 40-42°C to avoid hyperthermia and/or thermal injury to the animal. An advantage of the circulating hot-water blanket was the ability to select a water temperature that would not exceed this recommendation. The manufacturer of the microwaveable heating pad used in this study recommended a heating time of 3 minutes at the high setting. However, this heat time resulted in surface temperatures of nearly 47°C. The author decreased the heat time to 1.5 minutes (high setting) to achieve a surface temperature slightly less than 40°C for this study. The temperature of the table top used in this study was consistently measured at 22°C.

Both the circulating water blanket and the heating pad maintained body temperature of the mice and rats within 1°C of initial body temperature during the anesthetic period. In contrast, the animals anesthetized without supplemental heat experienced significant decreases in body temperature as early as 5 minutes post anesthetic induction. The maximum decrease in body temperature over the one hour anesthetic period in control rats was 8% (4.4°C). Body temperature in control mice had decreased by 14% within 35 minutes and 19% (10°C) by the end of the hour.

Both heating devices used in this study were shown to be effective in maintaining body temperature of anesthetized rodents. In addition, the results from the control groups underscore the importance of providing supplemental heat during general anesthesia to prevent potentially life-threatening hypothermia.

ARP veterinarians have used both warm water circulating blankets and various types of microwaveable gel packs with success. Some gel packs may be warmed by immersion in a hot-water bath which allows for greater control over the surface temperature. Although air activated hand and foot warmers have been recommended in the past experience has shown that surface temperature is highly variable with these products and overheating is possible.

Reference: Taylor DK, 2007. Study of Two Devices Used to Maintain Normothermia in Rats and Mice During General Anesthesia. *JAALAS*, 46(5): pp.37-41.

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Don't miss the Central PA
AALAS Branch meeting 3/4/08
at 3:30 pm in the CBL library.
Steve Benigni from Allentown
Caging will speak on the
evolution of rodent housing.

The Animal Resource Program (ARP) is committed to providing PSU research personnel with high quality animal care services and facilities, to facilitate and improve animal research, and to ensure the health, well-being and humane treatment of all animals at PSU. ARP provides veterinary and diagnostic services, personnel training and expertise in laboratory animal, agricultural and wildlife technology and medicine. ARP veterinarians have specialized training and are available to assist with animal model development, experimental design, budget projections and grant preparation. Participation in collaborative research projects is welcomed.

What's Wrong With This Mouse?

This photo shows a (euthanized) mouse with **congenital hydrocephalus**. Hydrocephalus occurs when there is an abnormal accumulation of cerebrospinal fluid (CSF) in the ventricles of the brain. CSF is produced within the brain ventricles and flows into the space between the brain and surrounding skull to act as a protective cushion. In congenital hydrocephalus infant animals develop an enlarged, dome-shaped head and show signs of mental dullness and ataxia. The build-up of CSF within the skull results in death of the surrounding brain tissue, and ultimately, death of the animal. Hydrocephalus in humans is associated with severe headaches and vomiting. No treatment exists for hydrocephalus in mice so affected mice should be euthanized.

Several spontaneous and targeted mutations and transgenes are associated with congenital hydrocephalus in mice and some are useful as models for human hydrocephalus. In addition, hydrocephalus is associated with several strains of inbred mice. The C57BL/6J and C57BLKS/J strains are most commonly affected although it occurs at lower frequencies in other strains. Hydrocephalus that develops in adult animals whose skull suture lines have ossified does not result in a domed skull. Acquired hydrocephalus in adult mice may occur as a sequela to infections with various rodent viruses including lymphocytic choriomeningitis virus (LCM). LCM is a zoonotic virus that also causes hydrocephalus in human infants when the fetus is infected in utero.

References:

Hydrocephalus in Laboratory Mice, Summer 2003. JAX/NOTES: No. 490.
<http://jaxmice.jax.org/library/notes/490f.html>.