

 THE UNIVERSITY OF QUEENSLAND AUSTRALIA CREATE CHANGE	UQ Animal Ethics Committee - Standard Operating Procedure LAB_058 Heating Procedures in Mice and Rats Institutional author: UQ Biological Resources AEC Reviewed & Approved: 06/05/2026 SOP Expiry: 06/05/2029	Version #1.1 Page 1 of 5
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LAB_058 Heating Procedures in Mice and Rats (Expiry: May 2029)

I. OBJECTIVE

To describe the heating procedure used to improve success of some procedures or as supportive care for UQ research projects, also reflecting the procedure used to train workers across UQ within UQBR.

NB: The use of (*) indicates this statement is dependent on the facility procedures

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II. DEFINITIONS

Competent - "the consistent application of knowledge and skill to the standard of performance required regarding the care and use of animals. It embodies the ability to transfer and apply knowledge and skill to new situations and environments." ¹

III. COMMENTS / RECOMMENDATIONS

To support welfare:

- Risk factors for hypothermia in rodents include the high surface area to body weight ratio, hair removal, use of wetting agents on the skin, anaesthesia (including short duration anaesthesia), invasive procedures and ambient temperature. Providing supplemental heat helps to prevent heat loss by increasing ambient temperature as well as providing warmth. Heating must be provided for all situations where there is a risk of hypothermia.
- The effectiveness of heating the body of the animal with all heating techniques will vary depending on the equipment, ambient temperature, length of exposure and the physiology of the animal. Heating procedures are only optimally effective if the temperature of the animal is being monitored and the heating adjusted accordingly. Use available methods of monitoring temperature whenever available and appropriate.
- The temperature of the heated surface or environment should be monitored frequently throughout the entire heating period to ensure the rodent does not overheat. Care must be taken as some rodents may not display signs of overheating, especially if unwell or during anaesthesia.
- If using heating for vasodilation, once the rodent reaches the target temperature it must not be exposed to the heat source for longer than 5 minutes. Consider temporarily separating rodents to allow for individual monitoring.
- Do not apply temperatures higher than those specified in this document to warm animals more rapidly. Exceeding the recommended temperature range may result in injury or thermal stress.
- Incorrect use of equipment or malfunctioning equipment creates a high risk of burns. Depending on the degree of the burn the damage may not be evident for several days. If burns are suspected refer to LAB_022 Managing Adverse Health Events in Mice and Rats.

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IV. SAFETY AND COMPLIANCE

- Possible risks include rodent bite injury, and psychosocial harm.
- The person undertaking this task must ensure all relevant approvals are in place, training has been undertaken, and risk assessments have been performed. If unsure, consult your supervisor.
- Sharp objects should not be used on a heat mat.
- Heat lamps should not be left unattended when turned on

V. TRAINING CONSIDERATIONS

Any training on live animals must be part of an approved process in an animal ethics project.

- All animal procedures MUST be performed by appropriately trained personnel:
 - Who have been deemed to be competent in the procedure.
 - Are confident in completing the procedure
 - OR be under the direct supervision of a person who is competent
- Workers trained by UQBR must complete:
 - Pre-requisite training such as handling and restraint
 - Relevant online learning

VI. EQUIPMENT

- PPE * *Minimum PPE is gloves and gown; additional PPE may be required based on facility or additional risk e.g. working with infectious material.*
- Disinfectant *
- Rodent cage (+ extra cages if individual monitoring is required).
- Heating device that is facility approved, fit for purpose and made for intended purpose* – heat mat, heat lamps.
- Thermometer* e.g. Infrared thermometer
- Timer for vasodilation procedures

VII. PREPARATION OF EQUIPMENT

If rodents require heating to induce vasodilation prior to procedures, ensure all preparations are completed beforehand – including equipment setup, labelling, and readiness of all necessary materials.

Use of heat lamps

- A heat lamp produces radiant heat which is absorbed by surfaces. The air may become warm as heated objects transfer heat via convection.
- A heat lamp should have temperature control features. I.e. controls correspond to the desired surface temperature and measure the warmth reaching the animal. This will differ from the animal's body temperature based on distance from the lamp, size, and positioning under the lamp.

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- Where a heat lamp does not have temperature controls, an infrared thermometer must be used frequently (every couple of minutes) to measure the temperature of the surface being heated. The heat lamp must not be left unattended when it is on in case it falls and causes overheating of the animals or a fire risk.
- An example of a suitable heat lamp option is [Able Scientific: Adjustable Height Infrared Heat Lamp](#)
- Suitable bulbs include:
 - 100W incandescent bulb – this filament is heated and produces warmth
 - Infrared bulb 150W - transfers heat to objects E.g. [Able Scientific: Infrared heat globes](#).

Use of heat mats

- Ideally, heat mats should have temperature control features, the controls correspond to the desired temperature of the mats surface. Check that the heat mat to be used has a tag indicating it has been tested for safety. Check also that there is no evidence of damage to the heat mat that may prevent it from heating or result in heterogenous heating areas. The heat mat is placed under the cage which will absorb heat. It may also heat the air immediately above it.
- If a heat mat does not have temperature control, an infrared thermometer must be used to measure the mats' surface temperature.
- An example of a suitable heat mat option is [Kent Scientific: Far Infrared Warming Pads with Controller](#) or [Able Scientific: Slide Warming Tray](#)
- Most heat mats take several minutes to reach optimal temperatures.
- Never exceed 43°C on the heating surface as this can cause burns or heat stress.
- Some heat mats will not maintain heat especially when placed onto a stainless-steel bench. Place a thin towel or bench paper between the bench and the heat to be sure.
- The thickness of the material between the mat and the animal will reduce the heat provided e.g. empty cage vs a cage with bedding.

Use of thermometers or temperature probes

- Temperature probes (rectal) are commercially available and designed for use in rats and mice.
- Digital infrared thermometers may also be used.
- An infrared thermometer will measure the infrared radiation emitted by a surface and use algorithms to estimate the core body temperature.
- Ensure the thermometer is used as per the manufacturer's instructions for accuracy, including adherence to the required distance from the rodent.
- Ensure the laser (if present) is pointing at the centre of the cage floor and/or rodent.
- If using to measure cage temperature, ensure the cage has been exposed to the heat source long enough.
- Take 2-3 separate measurements for confidence in the temperature measurement. If there is clear variation between the readings consider replacing the heating source as it may be faulty.
- The typical core body temperature of rodents is:
 - Mouse: 36.5-38°C
 - Rat: 37.5-38°C

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Other heating devices

- Use of heated breathing system E.g. [Darvall heated ZDS Qube](#)
- Use of Ventilated Cabinets E.g. [Tecniplast Aria BIO-C36 EVO](#)

VIII. PROCEDURE – Using heat mat or lamp

1. Turn on heat source to the desired temperature following manufacturer's instructions. Where temperature controls are provided follow the below table, unless the device specifically measures core body temperature. If there are no temperature controls available, use an infrared thermometer to confirm the surface temperature.

Purpose for heating	Temperature goal	Temperature setting
Supportive care e.g. post - procedure/recovery	36-38°C	40°C
Vasodilation for procedures to maximum 43°C as advised by David & Chen (2018)	43°C	43°C

2. Place the cage onto the heat mat, or under the heat lamp. *Never leave the rodent unattended from this point. Ensure ½ the cage is placed away from the heat source so the rodent can retreat if they choose to.*
3.
 - a) If using a heat lamp, remove the steel food hopper as this will absorb heat and may cause burns. Ensure the cage is placed at least 30cm away from the bulb.
 - b) When using heat mats, place a single layer of bench coat or paper towel between the animals and the mat to prevent direct contact and for hygiene purposes. Do not use thick or alternative materials, as these may alter heat transfer.
4. Keep the lid on the cage to prevent animal escape.
5. Use the heating devices built in feature or an infrared thermometer to measure the temperature of the rodent/surface. Adjust the temperature to reach the optimal temperature. This may require:
 - a. Adjusting in-built temperature settings OR
 - b. Altering the height of lamp such as raising the lamp head away from cage.
6. Progress through your procedure as per AEC approval. Continue to monitor the rodent's temperature and watch for signs of overheating throughout the entire heating procedure.
7. If heating for vasodilation, do not expose the animal to temperatures of more than 43°C. This is a maximum temperature; therefore, the exposure must be less than 5 minutes once the optimal temperature is reached. Use a timer to actively time this.

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		Page 5 of 5

8. If hyperthermia (overheating) is suspected, the animal should be immediately removed from the heat source completely. [Facility staff or veterinary advice may be required. Ensure that LAB_022 UQBR Managing Adverse Health Events in Mice and Rats is adhered to.](#) Signs of hyperthermia include:

- Increasing respiratory rate
- Jumping/increased activity
- Abnormal posture
- Distress
- Salivation and wet fur
- Bright red extremities.

IX. BIBLIOGRAPHY

1.NHMRC, 2013, Australian code for the care and use of animals for scientific purposes, National Health and Medical Research Council (NHMRC).

David, J., & Chen, X. (2018). Evaluation of warming devices for lateral tail vein blood collection in mice (*Mus musculus*). Journal of Pharmacological and Toxicological Methods, 94(1), 87-93. doi: 10.1016/j.vascn.2018.06.002

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Version #	Reviewing AEC	AEC Review Date	Outcome
1.1	Molecular Biosciences AEC	06/05/2026	Approved to 06/05/2029

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