

LAB_071 Grip Strength Tests for Rodents

I. OBJECTIVE

To describe the procedure for measuring grip strength in rodents. There are multiple suitable approaches that can be employed to undertake this task. Listed below are the most common.

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

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II. COMMENTS / RECOMMENDATIONS

- Behavioural assessments are ideally performed in a dedicated behavioural suite.
- The environment should be free from uncontrolled external stimuli that may influence the animal's behaviour such as human traffic, unnecessary noise, and intense lighting. Similarly, it is important that assessments are controlled for those stimuli which cannot be removed, such as such as time of day and light or dark phase.
- Male and female rodents should be tested separately, with one sex in the room at a time. Where possible males should be tested first, preferably on separate days but with at least thorough cleaning between the sexes. This is unless rodents are already housed within wire top cages or equivalent and both sexes are present in the home room.

III. EQUIPMENT

- PPE*

Minimum PPE is gloves and gown, additional PPE may be required based on facility or additional risk e.g. working with infectious animals.

- Appropriate trolley for transporting cages.
- Disinfectant*, little brush, and paper towel for cleaning equipment.
- Grip Strength Apparatus:
 - A) Grip strength meter** - An apparatus consisting of a digital display (of the readings), a force transducer and a grasping tool. Ideally, a standardised commercially available system is used.

Image 1. Grasping tools - the tool used is selected based upon the specific limb function to be tested;

a) forelimbs or hind limbs, b) forelimbs c) forelimbs and hind limbs, d) hind limbs.



a) T bar



b) Trapeze



c) Full grid



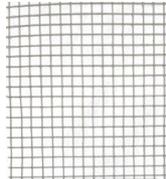
d) Half grid

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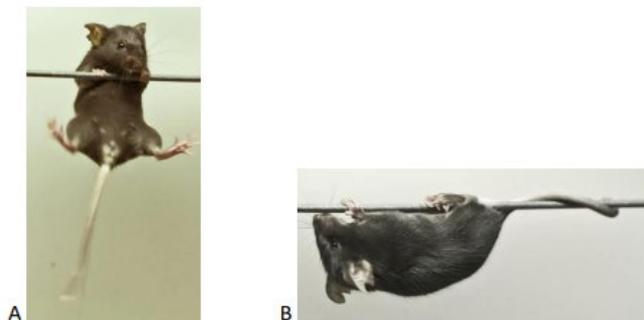
- B) Wire mesh screen** – The screen should consist of 12 x 12 mm squares, of 1 mm diameter wire. A timing device (e.g. a stop watch) is also required when conducting this test.

Image 2. Wire mesh screen – for use in the “Inverted screen test”



- C) Wirehang** – A single strand of wire should be mounted tautly between two points. The diameter of the wire and distance between these two points (length of the wire) should be 2mm and 60cm, respectively for mice, and 3mm and 90cm, respectively for rats. A timing device (e.g. a stop watch) is also required when conducting this test.

Image 3. (A & B) Typical presentation of mice under going the wire hanging test.



- D) Weights** – a series of weights is required consisting of a ball of tangled fine gauge stainless steel wire attached to steel chain links of different (total) weights. The total weight ranges from 20g to 100g for mice and 45g to 225g for rats (increments of 45g). A timing device (e.g. a stop watch) is also required when conducting this test.

Image 4. A series of weights as used in the weights test, of escalating total weight.



IV. PREPARATION

- Check AEC approvals to ensure that the correct procedure and personnel are approved for the planned work.**
- Prepare equipment items including disinfecting prior to first use.
- Bring rodents into the room (with lighting levels pre-set at the level required for the experiment) for at least 30 mins prior to start of experiment.

Length of habituation time in the testing room should be consistent for all rodents within an experiment.

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V. PROCEDURE

1. Record light levels in the middle of the arena, for reproducibility and consistency.

Lux range should be between 80-100 LUX and should remain the same for all rodents within an experiment.

2. Handling of rodents as per: [LAB_006 Handling and Restraint in Mice and Neonates](#)
[LAB_039 Handling and Restraint in Rats and Neonates](#)

3. Grip strength can be measured in one of the following ways:

A) Grip Strength Meter:

- 1) Holding the base of the tail firmly, gently swing the rodent onto the grasping bar or grid, making sure the rodent grasping the tool with the tested limbs.
- 2) Gently start pulling the tail horizontally, keeping a gentle constant pressure while drawing the animal backwards until they let go. Record the peak force in Newton or Gram Force.
- 3) Six to ten consecutive measurements per animal per testing day are recommended.

B) Inverted Screen Test:

- 1) Place the rodent in the center of the wire mesh screen, start a stopwatch
- 2) Rotate the screen to an inverted position over 2 sec, with the animal's head declining first.
- 3) Hold the screen steadily 30-40cm for mice and 60-70cm for rats, above a padded surface. Record the time when the animal falls off, or remove it when the maximum time is reached. Between 60-180 seconds is usually recommended, however this is highly dependent on strain and should be assessed prior to starting.
- 4) Repeat 3 times with a 30 sec recovery period between trials.

C) Wire Hanging:

- 1) The forepaws of the animal are placed on an elevated hanging wire 30-40cm above a padded surface for mice and 60-70cm above for rats, and the rodent is allowed to grasp the wire. Start a stopwatch.
- 2) Record the time when the animal falls off, or remove it when the maximum time is reached. Between 60-180 seconds is usually recommended.
- 3) Repeat 3 times with a 30 sec recovery period between trials.

D) Weights Test:

- 1) Hold the rodent by the base of the tail and lower it to allow it to grasp the weight (from the lightest to the heaviest) from the bench. As it grasps the ball of wire with its forepaws, start a stop clock and raise the rodent until the link is clear of the bench.
- 2) A hold of three seconds is the criterion. If the animal drops the weight in less than 3 sec, note the time it held the weight. Rest the mouse for about 10 sec and try it on the weight once again. If it fails three times, that terminates the trial, and the mouse is assigned the maximum time/weight achieved.
- 3) If the animal holds it for 3 sec then try it on the next heavier weight by repeating step 1) and 2).

4. Remove scat and thoroughly disinfect the apparatus and allow to dry completely before proceeding to the next trial.

NOTES:

Testing may be repeated over time to examine longitudinal changes in motor function. The frequency of testing over prolonged periods is dependent upon animal strain but can be as often as weekly. **

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VI. ANALYSIS

Grip Strength Meter: The average and maximum peak force for each animal obtained from all measurements per day should be recorded and plotted.

Inverted Screen Test & Wire Hanging: The average time for the 3 trials and the longest time the animal hanging onto the wire should be used. A more complex scoring system can be used for strains that deliberately fall or reach end of wire/edge of mesh, this can be reviewed [here](#).

Weights Test: A final total score is calculated as the product of the number of links in the heaviest chain held for the full 3 sec, multiplied by the time (sec) it is held. If the heaviest weight is dropped before 3 sec an appropriate intermediate value is calculated. Thus a mouse holding a 5-link weight for 3 seconds, but unable to lift a 6-link weight, is assigned a score of $(5 \times 3) = 15$. If it holds the 6-link weight for 1 second, it scores $(5 \times 3) + (1) = 16$.

VII. REFERENCES

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Version #	Reviewing AECs (note: all other relevant AECs ratify the approval)	AEC Review Date	Approval To Date
1	HS	16/12/2021	16/12/2024

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