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## Head-fixed Locomotion Task in Mice

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**We use this protocol and it's working**

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## Abstract

This protocol describes a head-fixed locomotion task used to study motor learning in mice suitable for recording neuronal activity concurrently.

## Image Attribution

Schematic of head-fixed training apparatus, showing mouse with head-plate running on a cylindrical treadmill.

## Guidelines

**Animals:** Mice are placed in a reverse 12h light/dark cycle room for at least one week prior to training.

## Troubleshooting

## Safety warnings

! Wear appropriate PPE as required by your institution.

## Ethics statement

Prior ethics approval (e.g. IACUC) should be obtained before performing these experiments. Approval was obtained by the Stanford University IACUC before any procedures were performed.

## Before start

Mice in this task must have a head plate which is typically a minor surgery prior to this protocol.

**Water restriction required (2 days):**

Mice are water restricted and fed with ~1 ml of water per day. After 2-3 days, their body weight should be reduced to 85-90% of baseline weight and maintained throughout training.

## Habituation (3~7 days)

- 1 Following water restriction mice will be habituated to head fixation and receiving water from a water port for at least 3 days.
- 2
  - Over the course of habituation mice will be gradually habituated to longer head fixation times by being placed on the head-fixation setup.  
**Note:** Head-fixation times per day depend on mouse comfort and will increase gradually until mice are comfortable for at least 20 minutes and actively drink water from the water port.
- 2.1 Mice are placed in the head fix set up for ~5 minutes on day 1.
- 2.2 Mice are placed in the head fix set up for 5~10 minutes on day 2.
- 2.3 Mice are placed in the head fix set up for 15~20 minutes on day 3.

## Training (5+ days)

- 3 Habituated mice are trained for at least 5 training days.
- 4 Each day, mice are placed on the head-fixed training apparatus, which consists of a head-plate holder, a cylindrical rod treadmill, and optionally a water delivery port (Fig. 1 in attached protocol).
  - 4.1 Each training day mice are trained for one training session, typically lasting 15-30 minutes.
  - 4.2 During this time mice are head-fixed on the behavioral apparatus and their position adjusted so that the four limbs are resting on the treadmill. Mice are allowed to run on the treadmill at will and optionally receive a water reward for a given distance run.
- 5 Training will last for at least 5 training days.



- 6 Running performance will be measured using a high-speed IR camera, as well as a rotary encoder to measure treadmill rotations.