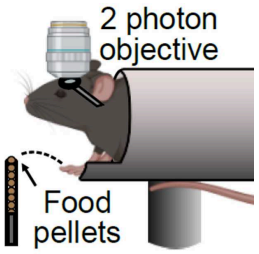
Jan 30, 2025

Head-fixed Forelimb Reaching Task in Mice



DOI
https://dx.doi.org/10.17504/protocols.io.j8nlk96q6v5r/v1

Richard Roth[1], Yue Sun[1], Fuu-Jiun Hwang[1], Jun B. Ding[1]

[1]Stanford University

Christine Weber-Schmidt
Allen Institute

DOI: https://dx.doi.org/10.17504/protocols.io.j8nlk96q6v5r/v1

Protocol Citation: Richard Roth, Yue Sun, Fuu-Jiun Hwang, Jun B. Ding 2025. Head-fixed Forelimb Reaching Task in Mice. **protocols.io** https://dx.doi.org/10.17504/protocols.io.j8nlk96q6v5r/v1

Protocol status: Working
We use this protocol and it's working

Created: January 16, 2025

Last Modified: January 30, 2025

Protocol Integer ID: 118573

Keywords: ASAPCRN, task in mice, motor learning, memory in mice, recording neuronal activity, reaching task, fixed forelimb, neuronal activity, head, mice, memory, activity, study

Funders Acknowledgements:
Aligning Science Across Parkinson's (ASAP)
Grant ID: ASAP-020551

Abstract

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

Attachments

DOCX

Ding Lab_Head-fixed ...

3.7MB

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

Food Restriction (2 days)

1 Mice are food restricted and fed with ~0.1 grams of food per 1 gram of body weight per day. After 2 days, their body weight should be reduced to 85-90% of baseline weight and maintained throughout training.

Habituation (3~7 days)

2 Following food restriction mice will be habituated to head fixation and consuming food while head-fixed for at least 3 days. Over the course of habituation mice will be gradually habituated to longer head fixation times.

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 consume food pellets while head-fixed.

2.1 **Day 1**: Place mouse on on the head-fixation setup for ~5 minutes.

2.2 **Day 2**: Place mouse on on the head-fixation setup for 5~10 minutes.

2.3 **Day 3**: Place mouse on on the head-fixation setup for 15~20 minutes.

Training (8+ days)

3 Habituated mice are trained for at least 8 training days. Each day, mice are placed on the head-fixed training apparatus, which consists of a head-plate holder, a mouse body restraining tube, and a food pellet delivering system.

Each training day mice are trained for one training session, typically lasting 15-30 minutes. During this time mice are presented with one food pellet (20mg) at a time and can self-initiate reaching movements to retrieve the pellet.

Mice that do not perform any reaching movements on the first 3 days of training will be removed from the study. Training will last for at least 8 training days.

4 Reach performance is monitored via high-speed IR camera and categorized by recording the type of each reach:
● Success: The mouse reaches with its trained limb, grasps the pellet, retrieves it, and feeds it into its mouth.

- Drop: The mouse reaches and grasps the pellet but drops it before feeding.
- Fail: The mouse reaches but misses or knocks the pellet off the holding plate.
- In-vain Reaches: Reaches made when no pellet is on the platform; not counted towards total reaching attempts.

Success rate is calculated by the formula: Number of Success reaches / (Success + Drop + Fail reaches).