Challenge 31- MOuse Smart HoppERS (MOSHERS)

Sponsors: MRC Harwell Institute

Launch Meeting

6 September 2018
The Challenge

To monitor and accurately measure food intake in a home cage - directly or indirectly

Deliver *individual* data on three to five mice housed together
The Problem

Monitoring food intake needs specialist equipment and space.
The Problem 2

Behaviour changes when singly housed

Food intake using two separate metabolic cage-type monitoring systems (mutants in red)
The Problem 3

Monitoring food intake in home cages is labour-intensive and requires disturbing the animals every day.
In this example, we expect that confounding factors such as neophobia and anxiety may be affecting the animal’s feeding behaviour.
The Problem 4

Existing multiple housed systems are:

a) too expensive for wide-spread use
b) data-heavy requiring expertise and IT infrastructure
c) require a modification inside/outside the cage
Current state of the art- Summary

Weighing home cage hoppers
  Limited accuracy and sensitivity
  Averaged over mice in cage
  No account of hierarchy

Specialised metabolic caging
  “Accurate”
  Single novel housing = stress = altered FI

Home cage monitoring
  “Accurate”
  Not scalable for many cages
Why was this Challenge developed?

Scientific  
- Food Intake (FI) in energy balance  
- Feeding behaviour  
- Obesity, diabetes, metabolic disease

Business  
- Existing systems confounded by stress  
- Loss of metadata (when/how much/how long)  
- Lack of larger datasets
3Rs drivers

Monitoring Welfare:
• Weight loss is one of the most common welfare indicators used with mice
• Mice are likely to reduce activity and feeding before weight loss
• Opportunities for EARLY welfare indicators

Early and accurate intervention:
• Adjustment of analgesia routines
• Detection of early onset indicators (e.g. neurodegenerative models)

Innovations in Welfare:
• NEW information on animal behaviour and feeding which may lead to refinements of procedures such as fasting, post-surgical care and maintaining genetically altered mouse lines
Deliverables

A DEVICE for everyone delivering a time series of data representing food intake.

• Compatibility with all existing cages
• Mouse friendly (no training or intervention)
• Affordability
• Accessibility – easy data analysis and Cloud potential
• Portable and easy service
• Collect data on individual cages (1)
• Collect data on individual animals (2)
What we don’t want

- Disruption of the home environment
- Single housing
- Difficult data analysis
- Expensive to buy, run and maintain
- Hard for technicians to operate in high throughput settings (set up/take down/clean)
- Low-level adoption and non-standardisation of food-intake measurement.
Sponsor in-kind

- House 55k mice
- 2017:
  - 197k regulated procedures
  - 229k mice bred
  - 133 new GA lines

- In-house validation with wild type and mutant lines including a comparison of data from paired-feeding, metabolic and calorimetry caging data.
- Advice and ideas in device design
- In-house testing of a prototype device
- Data critique and validation
- Access to a wide network of mouse genetic researchers (inside and outside of Harwell) for advice/analysis and critique.
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