



An International Centre for Mouse Genetics

MRC

Harwell
Institute

Challenge 31- **MO**use **S**mart **H**opp**ERS** (MOSHERS)

Sponsors: MRC Harwell Institute

Launch Meeting

6 September 2018



NC
3R^s

CRACK IT

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



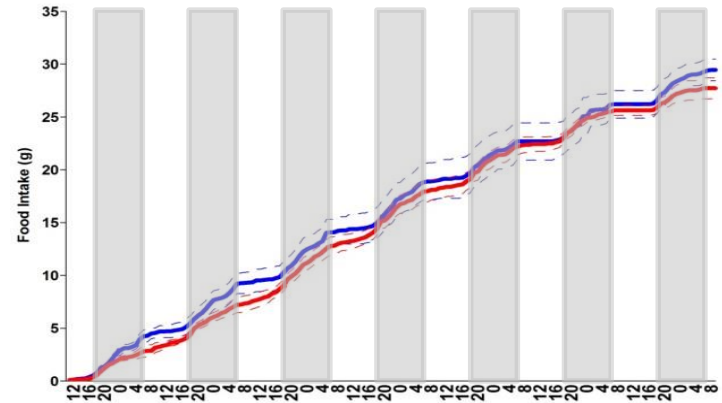
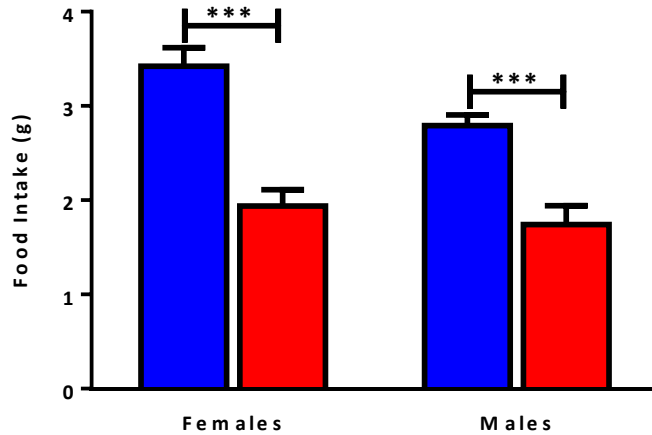
The Problem

Monitoring food intake needs specialist equipment and space



The Problem 2

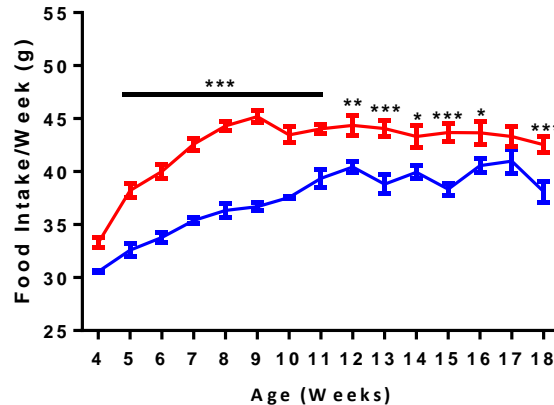
Behaviour changes when singly housed



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

The Problem 3

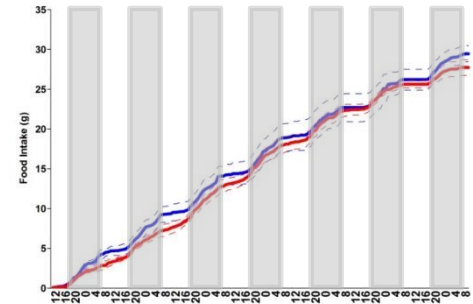
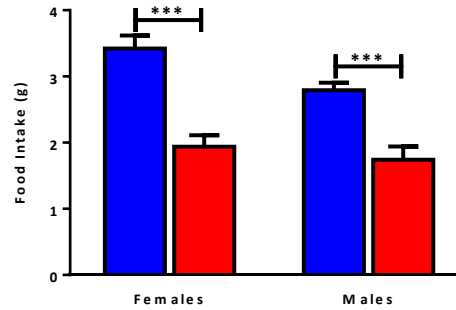
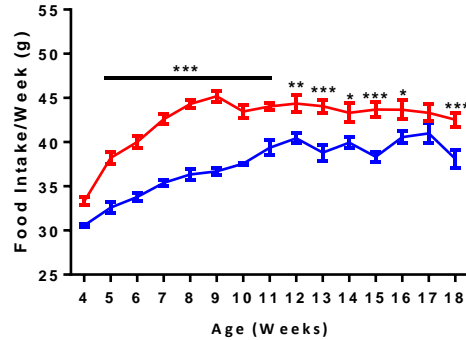
Monitoring food intake in home cages is labour-intensive and requires disturbing the animals every day



Home cage food intake monitoring

Otp- metabolic mutant

(*Mol Metab* 2017 **6**(11) 1419)



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 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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