

Mouse behaviour core at the Francis Crick Institute

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Abstract

The Mouse Behaviour Core is a self serve facility located in one of our main experimental units. It provides a dedicated area to perform behavioural testing of genetically altered and wildtype mice to determine the effect that gene alteration has on behaviour, memory, learning and motor function.

The requirement for expanded Containment Level 3 facilities led to the relocation of our previous behaviour suite and provided the opportunity to create a new area specially designed for various behaviour tests. It has been open for just under a year and has allowed researchers to carry out a variety of behaviour related research, under Project Licence authority.

In this poster we are going to cover how the Biological Research Facility and associated Animal Technicians support the researchers to carry out their work, whilst ensuring Animal Welfare is kept to a high standard.

Why do we study behaviour of animals?

Animal behaviour has been studied in laboratories since the early 20th century but has been increasingly used in the last 2 decades. There are more than 100 behavioural tests available in publication and many are still in development.

We use mice in our behavioural research as they have a lot of similarities to humans: anatomical, physiological, and genetic. By understanding animal behaviour, we can create a better understanding of genes, as well as regions of the brain and its circuits. It can also be used to see how drugs and/or treatments can affect mouse behaviour.

These results can then be analysed/interpreted and translated into human understanding (Figure 1).

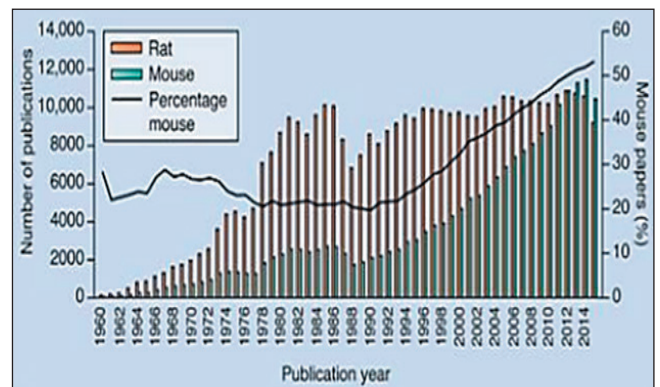


Figure 1. Graph showing the increase of publications on mouse behavioural studies.

What happens in the mouse behaviour core at The Crick?

The Biological Research Facility (BRF) behaviour core (figure 2) is set up for various behaviour related tests which can be broken down into four main categories:

- learning and memory
- anxiety
- social
- motor function

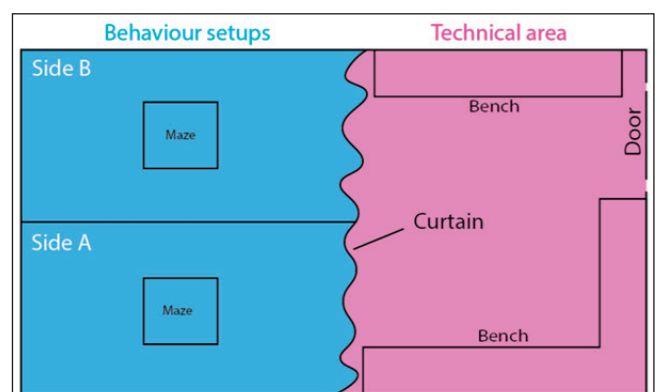


Figure 2. Bird's eye view of the behaviour core.

Under each category there are a number of tests that can be performed using various mazes and set ups supplied by the BRF.

Each individual area (Figure 3) is booked on the dedicated online booking system (PPMS) by the researchers to avoid disappointment and to help with planning experiments.



Figure 3. Behaviour core setup.

Behavioural tests used in the behaviour core

Learning and memory

The Barnes Maze which is a circular table (Figure 4) with circular holes around the outside. The objective is for the mouse to reach an escape box under one of the holes. The animal uses visual cues and prompts allowing assessment of memory and spatial learning.



Figure 4. Barnes Maze.

The Y Maze (Figure 5) is a test used to assess working or short term memory. A mouse is placed in the centre and observed. Mice with intact working memory have been shown to more likely explore areas that it has not visited before.

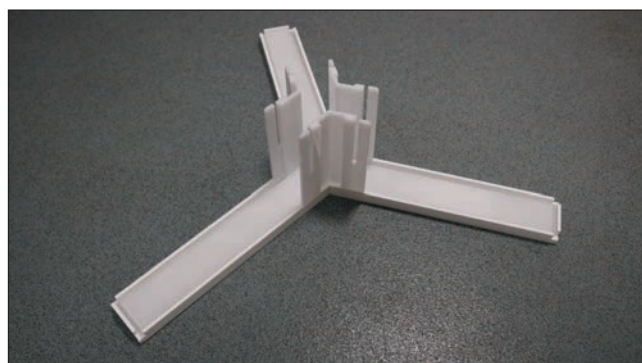


Figure 5. Y Maze.

Anxiety

The light/dark test apparatus (Figure 6) is made up of a dark chamber and a brightly lit chamber. Mice are allowed to move freely between the two chambers. This measures anxiety like behaviours using their aversion to open spaces as when anxious mice are more likely to prefer dark enclosed areas.



Figure 6. The light/dark test.

The open field test (Figure 7) involves releasing a mouse into a new area called an 'arena'. Movement and reactions are recorded which provides information on anxiety related behaviours when in an unknown environment.



Figure 7. The open field test.

Social

The three chamber test (Figure 8) evaluates cognition and has shown that normally mice prefer to spend more time with another mouse. The equipment consists of three separate rooms and provides an insight into their thinking processes and desires to interact with each other.



Figure 8. Three chamber test.

The tube dominance test (Figure 9) is where mice are trained to walk forward in the tube. Two mice are then put into the tube at opposite ends and the animals walk towards each other, where they can interact in the middle. This test is typically used to test the hierarchy of a group of mice living in the same cage.

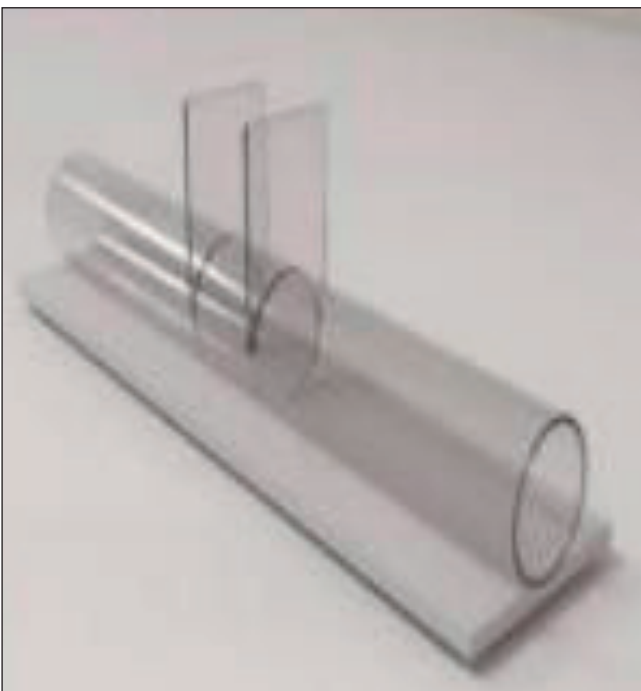


Figure 9. Tube dominance test.

Motor function

The Rotarod test (Figure 10) is designed to monitor motor coordination, balance and fatigue. The apparatus consists of a circular rod that turns at a constant or increasing speed. The mice must continue to hold on and climb around the rod as it spins. This tests the effects of genetic alteration, drugs, brain damage or diseases.



Figure 10. Rotarod test.

The Catwalk test (Figure 11) is when mice are put onto the catwalk where they walk along the illuminated glass platform. A camera measures and records the animal's movement and their gait can be assessed and evaluated.

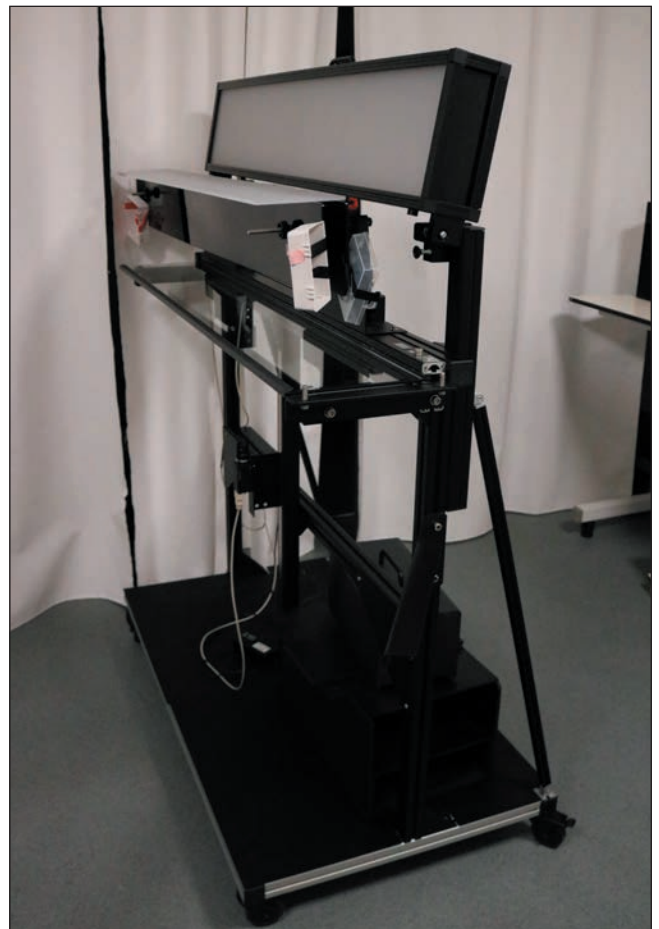


Figure 11. Catwalk test.

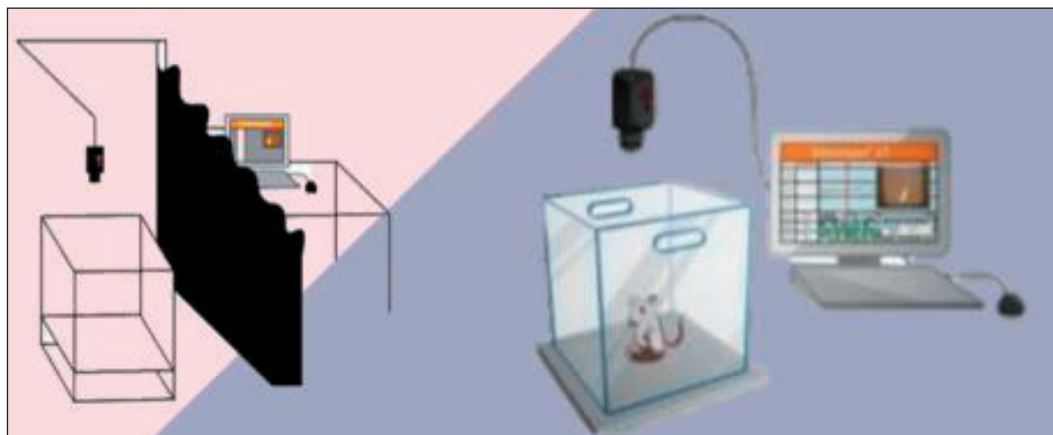


Figure 12. Ethovision video systems.

Ethovision video system

All the mazes are set up under cameras which are connected to the Ethovision video system (Figure 12). Ethovision XT is a video tracking software that tracks and analyses the behaviour, movement and activity of mice. The data recorded can then be stored and analysed/interpreted by the researcher later.

Future plans for the behaviour core

With the increasing usage of the area, plans have been put in motion for the BRF and the research officers (RO) working within, to be trained in performing behavioural tests for the researchers. This will allow the researchers to make more efficient use of their time and will also allow some variety and progression in the RO role.

To maintain the productivity of the area, the BRF will be sending out a 1 year survey to all researchers to ensure the area is fit for purpose, the correct equipment is available and if further support can be offered.

This will enable the BRF to have greater oversight of any welfare issues that may arise from the tests and maintain the best possible husbandry and welfare practices.

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The process of using the behaviour core

