



POSTER PRESENTATIONS

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Validating in-cage mouse enrichment

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Abstract

There is a wide variety of different types of mouse enrichment currently available, some items of which are more practical than others. Validating items used for providing enrichment can be time consuming and costly, nevertheless it is important to ensure that any objects being provided for this purpose are truly offering enrichment opportunities for the animals. The purpose of this study was to demonstrate how a quick and simple cage side assessment can be undertaken to identify which items are most effective as enrichments and whether they offer short- or long-term solutions. The study compared four different types of enrichment, all of which are easily available, in five cages of pair housed 6-month-old CD1 mice. Through this approach, we found that the mice preferred items suspended from the cage lid. Using this information, we have identified a practical and cost-effective solution and confirmed that it maintains novelty over longer periods. This validated enrichment is now being used routinely in the Biomedical Services Unit at the University of Birmingham.

Hole-ee Roller Balls



Figure 1. Hole-ee ball.

Scenario: We filled each ball with nesting material, in addition to that provided within the cage and suspended the ball from the cage lid. Each morning we scored use of the balls from 0 to 3, 0 being the nesting material was not disturbed, 1 being the nesting material was disturbed but not removed, 2 being that some nesting material was removed but not entirely and, 3 being that all nesting material was removed from the ball. Each cage was scored each morning and the nesting replenished.

Resources:

- **Time:** It takes a minimum of 30 minutes to set it up, including sanitising, drying, stuffing the ball with new nesting material and then putting it into the cage.
- **Costs:** balls are relatively expensive, require frequent replacement, nesting inside is cheap and easy to replace.
- **Maintenance:** sanitise before and after use, autoclave not used due to manufacturing material. It requires someone to take out the little pieces of chewed material from the cages daily to reduce possible choking.

Observations: Instant attraction, did not lose interest. Showed interest in pulling enrichment out of it as well as the ball itself. The mice excessively chewed the blue and green balls for unknown reasons. Provides different enrichment opportunities as can change the contents and position in the cage (floor vs lid). C57Bl6/J animals also showed high level of interest outside of this study.

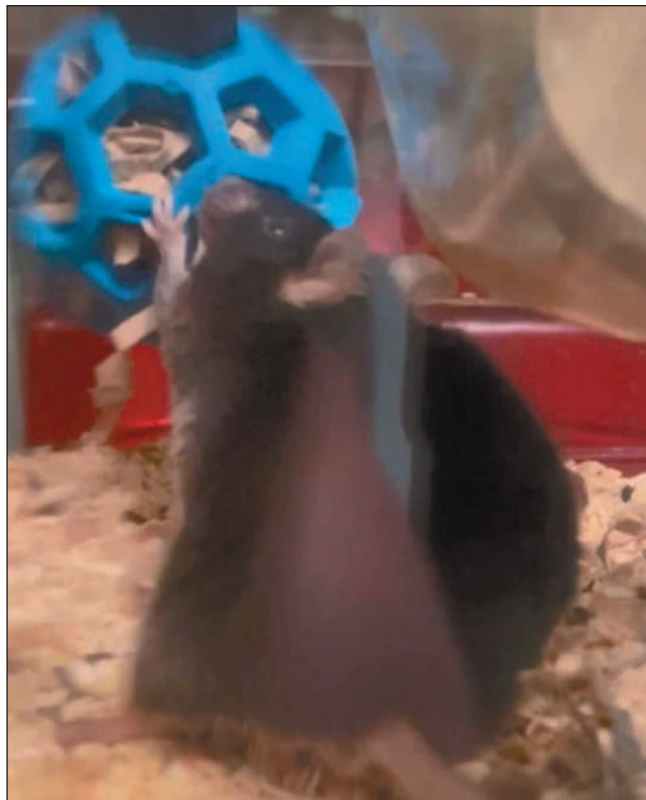


Figure 2. Mouse in cage interacting with Hole-ee ball.

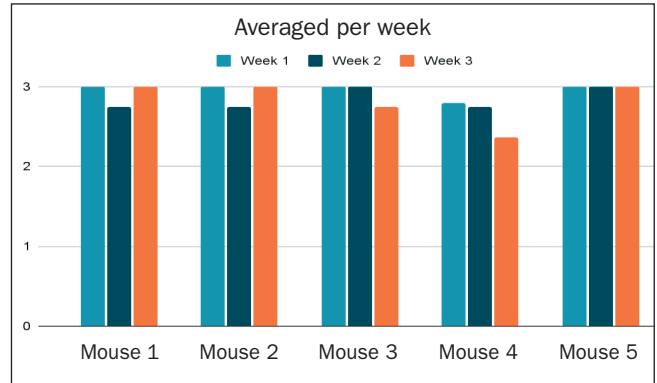
Pros:

- Very high degree of interest seen in all animals.
- Prolonged enrichment.
- Can use them in different ways.

Cons:

- Time consuming to put the nesting in.
- Expensive as balls need replacing frequently.
- Cleaning takes time as has to be done by hand.

Enrichment ends once nesting removed.



Wheels

Scenario: We attached a wheel to the cage lid and applied a sticker to the top of the wheel itself. We observed the cage each morning for 15 minutes and then checked the wheel for the position of the sticker. We scored use of the wheels from 0 to 2, 0 being no evidence of use, 1 being we had not observed use but the sticker had moved indicating interaction and 2 being they had used it during the observation period.



Figure 3. Running Wheel including attachment to the cage.

Resources:

- **Time:** Easy and fast to put into cage after autoclaving by clicking into place on the wire lid.
- **Costs:** Relatively expensive but do not require frequent replacement.
- **Maintenance:** Sanitised in autoclave. Replaced during routine cage clean, or more often if dirty.

Observations: Interest varied between animals, with some becoming more interested over time and some less. No animal was routinely observed using the wheels, generally use was assumed based on movement of the sticker. Where wheels have been provided to other animals outside of the study, young animals appear to have a preference for them.

Pros:

- Provides an opportunity for exercise.
- Easily cleaned and can be autoclaved.
- Cost effective over the longer term.

Cons:

- High degree of variability between animals, so not a universal enrichment for all.
- Hard to monitor use to confirm if providing enrichment for individual animals.

Wheel uses a lot of cage space.



Figure 4. Mouse in cage with wheel.

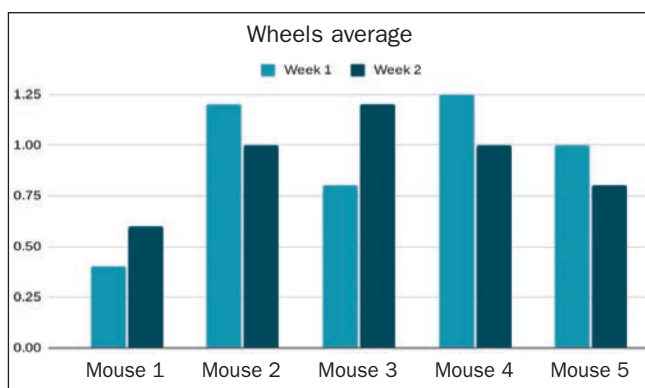
**Aspen chew blocks**

Figure 5. Aspen blocks – available sizes.

Scenario: At the start of each week, we removed any old chew blocks and replaced with new (one per mouse in the cage). We weighed each chew stick before and after it was added to the cage to determine how much they had been used over time (figure 7). The graph shows the average amount of chew stick (grams) consumed each week per cage.

Resources:

- **Time:** Easy and fast to add to each cage.
- **Costs:** Very cheap, need replacing frequently.
- **Maintenance:** Sanitise in autoclave before use. Need to regularly remove broken pieces of chew sticks from cage. Replace weekly in some cages.

Observations: Immediate interest but this lessens over time. Follow-up observations indicate that novelty restored after removed for a week. Interest varied between individual animals.



Figure 6. Mouse ‘enjoying’ an Aspen block.

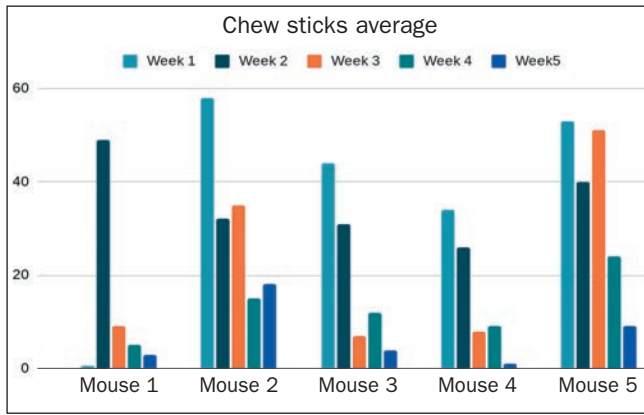


Figure 7. Amounts of chew stick utilised by mice.

Pros:

- Helps prevent overgrown teeth.
- Low maintenance.
- Easily autoclaved and stored.
- Do not take up much room in the cage.
- Easy to judge if providing enrichment on a case-by-case basis.

Cons:

- Need to remove splinters and monitor for blocks becoming too small.
- Enrichment lost as item consumed.

Interest decreases over time so needs to be rotated with other enrichment.

CellPad

Scenario: We attached a new cell pad to the cage lid at the start of the week and scored use each morning. CellPad was provided in addition to normal nesting material. We scored on two levels; percentage of CellPad destroyed and, of that, the percentage that had been incorporated into a nest. These percentages are plotted on the graph.

Resources:

- **Time:** Easy and fast to add to each cage.
- **Costs:** Very cheap, need replacing frequently.
- **Maintenance:** Sanitise in autoclave before use. Need to replace at least at cage change, if not more regularly to provide a constant source of enrichment.

Observations: Immediate and maintained interest. Some variation between individuals but overall, use was high and has also been observed in other strains outside of the study. All animals incorporated most of the material into the nest.

Pros:

- Enrichment from both destroying the CellPad and incorporating into nest.

- Novelty maintained over time.
- Universal interest from all animals trialled.
- Easily autoclaved and stored.
- Provides additional insulation for litters.

Cons:

- Enrichment lost as item is consumed.

Have to limit number of CellPads provided between cage cleans as material accumulates and blocks view of the animals.

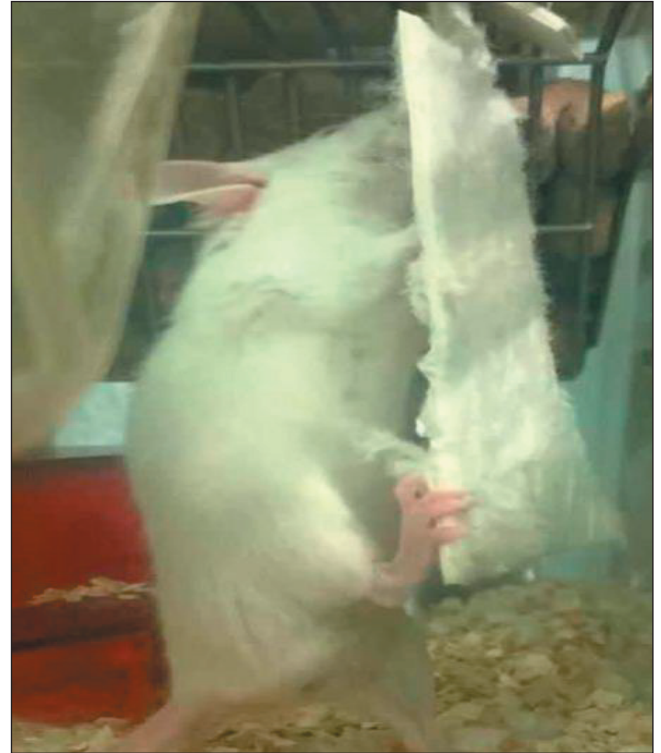


Figure 8. Mouse breaking down the CellPad.



Figure 9. Shows incorporation of CellPad into next structure.

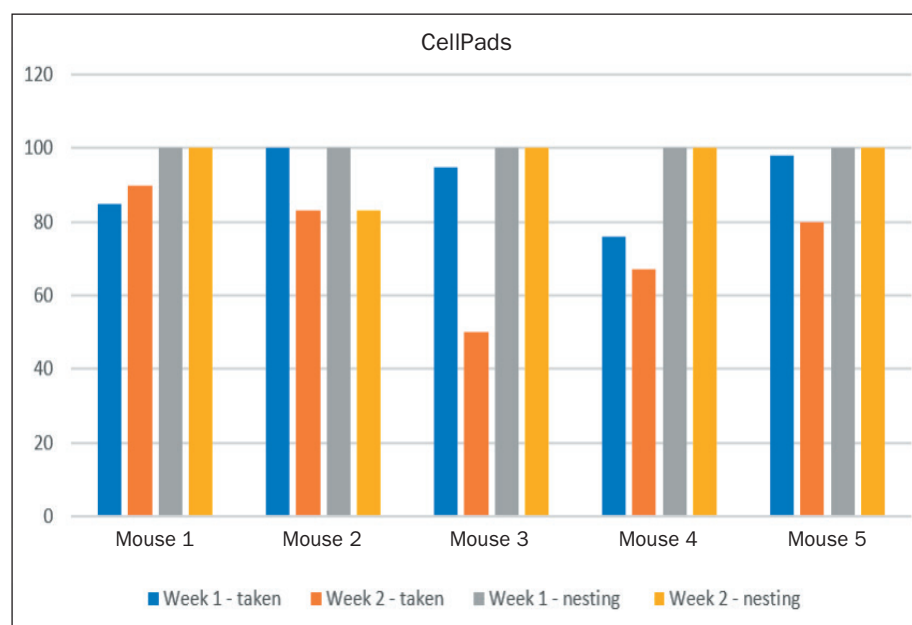


Figure 10. Analysis of CellPad use.

Summary

From the study, we have concluded that all of the items trialled have their pros and cons and that it is important to validate items as providing enrichment, rather than assuming this.

Whilst the mice showed a prolonged interest in the balls, this was not sustainable due to the high level of resources required. Based on this, we identified the CellPads as a possible alternative that offered a similar type of enrichment. Both the Cellpads and chew sticks were the most effective, due to their low resource requirements, ease of use and interest shown by the animals. They were also the most universally suitable for use in different scenarios.

Further studies are required to determine whether novelty is retained over longer periods or can be revived after removal for a period of time or if there are certain scenarios where wheels consistently offer an enrichment opportunity. However, based on the data from this study, as a facility we are now confident in our routine use of chew sticks as an enrichment item and also use the CellPads where we require additional enrichment such as mice that are showing signs of aggression or are unavoidably singularly housed.