

Going Above and Beyond for our Animals

Abstract

The exploration of diseases such as autism, depression, Huntington's, Alzheimer's, and Parkinson's has led to the use of various forms of head implanted animal models at our institution. Due to the size and positioning of the implant, traditional rodent cages with wire lids that house the water and food supply posed some challenges such as damage to the implants, the need for a gelled hydration source and food to be placed on the cage floor. With the mission of "flawless animal care" in mind, we set out to improve the cage design for these animals. The ultimate goal was to provide a caging system that provides optimum space for the animal and to design a water bottle and feeder to allow *ad lib* water and food consumption without compromising the head implants. We partnered with Animal Care Systems to modify their existing OptiRat Plus® and OptiMice® caging systems. Design modifications were made and led to a successful implementation of this new caging system for our rat models in December 2013 and our mouse models in December 2014.

Background

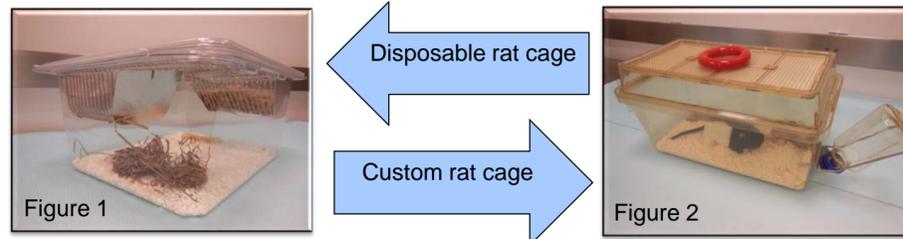
We have used both rat and mouse models for studies that require implanted head cannulas. Traditionally, the rat models with head implants were housed in a static cage without the wire lid to prevent injury to the animal and damage to the head implants. Food was placed on the floor, as approved by the IACUC, and a gelled water supplement was used as the animal's hydration source and replaced daily. The mouse models were housed in our standard disposable caging with slight changes to our standard. The food hoppers were removed for similar reasons as in the rat caging and the food was placed on the floor of the cage, as approved by the IACUC. A gelled water source was placed on the cage bottom and replaced daily. Empty water bottles were placed in the cage lid to prevent chew-outs in the disposable cages.

But we wondered.....Can we do better?

Materials

Rat Models

- We started with our standard disposable rat cages (Figure 1), however due to concerns with the wire bar lids damaging the implants we changed our focus to static caging (Figure 2) for rats.



- We removed the wire lid within the cage and placed the food on the floor of the cage. However, this still left the rats without a liquid water source. We reached out to the vendor and sourced custom water bottle holders that were external to the cage. We then drilled holes on the side of the cage for the sipper tubes. We still felt we could do better and wanted to house the animals in individually ventilated caging (IVC) to align with the rest of the vivarium.

- Finally we partnered with Animal Care Systems (ACS) and through numerous designs and modifications determined the optimum design which included the proper angle needed for the sipper tubes (Figure 3) for liquid water. We were also able to get custom J-Feeders (Figure 5) for food delivery specifically that worked with the OptiRat plus® caging system (Figure 4).

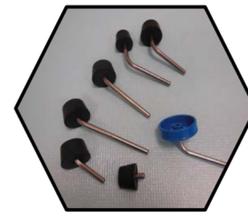


Figure 3



Figure 4



Figure 5

Mouse Models

- We had been housing the mouse models in our standard disposable mouse cages through most all of 2014. Due to the successful implementation of the OptiRat plus® caging system, we approached ACS with a desire to make a similar environment available to our head implanted mouse models. There were inherent design differences between the OptiRat plus® system and the OptiMice® caging systems. The biggest difference being that the water bottle is housed within the OptiMice® caging as opposed to it being on the outside of the cage in the OptiRat plus® caging.
- The first goal was to address our primary concern of the mice getting underneath the water bottle and causing damage to the head implants. Our second goal was to provide a ground level food hopper. We were able to be a part of the design process and offer suggestions and ultimately both goals were achieved!
- ACS provided several iterations of the design based on our feedback for the shield insert needed to protect the mice. Initially we had the hopper (a J-feeder) as a separate piece but felt we could combine the two so that there was only one extra component to wash instead of two. The results are illustrated below (Figures 6-7) and have shown us great success.
- The design continues to be a work in progress. Figures 8-9 show the latest design modifications based in large part to our feedback. The bottles are easier to place in the shield and a greater angle of the sipper along with a ball point sipper tube has reduced water leakage significantly.



Figure 6



Figure 7



Figure 8

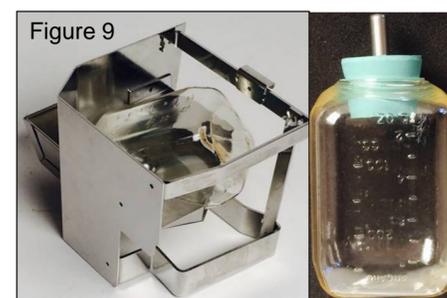


Figure 9

Results

Through multiple designs, re-engineering of parts, and successful collaboration with Animal Care Systems and our Regulatory and Operations teams, we were able to achieve the following:

- Refinements in animal welfare with improved well being
 - Housing in ventilated caging as opposed to traditional static housing for the rat models
 - Increased housing space, in particular vertical space for animals
 - Access to liquid water as opposed to gelled water alternatives
 - Increased efficiencies for husbandry tasks
 - Cost savings in gelled water supply and time
 - Sharing knowledge with universities and other industry leaders in the Cambridge area that have inquired about our design and the positive impact on the research
- Anecdotal information from the researchers as a result of these new housing environments included quicker surgical recovery, faster acquisition to behavior tasks, and improved study related data and results.

Conclusions

The entire project started with a simple question, "Can we do better?" Our answer was a resounding **YES!**

Just because there wasn't a suitable caging system available, we didn't let that stop us. Instead, we challenged the *status quo*, explored alternative options and ended up facilitating a new caging design. Working with the vendor through the multiple re-engineering efforts and testing on site led to drastically improved microenvironments for these animal models. Our primary goal of providing improved animal welfare for these animal models was attained. Other benefits realized included cost savings and evidence of a positive impact on the studies. Our sincere hope is that this work will benefit similar animal models at other Institutions and beyond.

Acknowledgements

We would like to thank our colleagues in the animal unit for supporting us in this effort. A special thanks to Animal Care Systems for partnering with us to find the optimum designs for delivering food and liquid water to our head implanted animal models.