A laboratory animal veterinarian's thoughts on modern rodent caging

Individually ventilated caging (IVC) systems for rodents were first marketed more than 30 years ago and have been in general use for more than15 years. Years ago, filter tops were added to shoebox rodent caging to prevent cage-to-cage transmission of pathogens. The addition of the filter tops significantly reduced cage ventilation, resulting in major differences between micro- and macroenvironmental conditions, with the accumulation of ammonia and humidity in the unventilated cages and with a potentially negative impact on the animals.

Ventilated caging systems were designed to improve the microenvironment by providing a dryer environment with low ammonia levels inside the cage. These systems provide an environment that allows for longer periods between cage changes without having a negative impact on the animals. They provide a barrier at cage level and, thus, can be used both to protect animals that are free of pathogens and to quarantine animals of unknown health status or animals know to harbour pathogens.

Decrease in stress, increase in comfort?

Because IVC systems improve the microenvironment and can reduce handling by personnel resulting from fewer cage-cleaning procedures, many researchers believe that animals housed in these systems experience reduced stress and discomfort. However, there is some concern that high intra-cage ventilation rates could induce chronic stress and heat loss in the resident animals because of exposure to drafts, as noted by Baumans et al. (Contemp. Top. Lab. Anim. Sci. 41, 13–19; 2002). Environmental comfort in animals is difficult to assess, because physiological "well-being" is a subjective concept.

Air supply is important

The last five institutions with which I have been associated are all committed to IVC systems. This has given me experience with more than 1,500 IVC racks manufactured by five companies. This includes experience with cages with air supply just above the bottom of the cage and cages with air supply through the cage top. Each of these systems provided about 50 to 60 air changes per hour (AC/h) and gave good control of the microenvironment. Subjectively, the animals housed in these systems did very well. They behaved normally, had normal breeding efficiency and were healthy, regardless of where the air supply to the cage was located.

Previously published results from researchers at The Jackson Laboratory in Bar Harbor, Maine, US (Lab. Anim. 37, 44–53; 2003), have shown that a ventilation rate of 60 AC/h provides an optimum environment for mouse reproduction and growth. They also reported that reducing the frequency of cage changing to 14 or 21 days did not adversely affect the health of the animals, weanling weight, animal growth, plasma corticosterone levels, immune function, breeder mortality or breeder productivity. Pup mortality was highest when cages were changed every 7 days. Other references have shown that breeding efficiency is the same in IVC systems as it is in non-ventilated caging (Lab. Anim. 35, 51–57; 2001 and Lab. Anim. 35, 58–73; 2001).

If there is a significant difference in IVC systems, it may be the route by which air is supplied to the cage. The question is whether it is preferable to supply air from just above the bottom of the cage or from the top of the cage. In some systems using air supply in the cage top, there seem to be 'dead air' pockets in the cage or ineffective and incomplete air changing in the cage. In a comparative study of three IVC systems, two with air supplied just above the bottom of the cage and exhausted over the lip of the cage and one with air supplied and exhausted at the top of the cage, Tu and colleagues from the Harvard School of Public Health in Boston, Massachusetts, US (Contemp. Top. Lab. Anim. Sci. 36, 69–73; 1997), showed that cages with air supply near the bottom exchanged air in the cage better and more completely than systems with air supplied in the top of the cage.

I believe that IVC systems provide benefit to the animals and to the personnel who handle the animals, provided that the systems are used in the way they were designed to be used: handling one cage at a time in a properly operating change station or biosafety cabinet. The animals enjoy improved microenvironmental conditions and allergen exposure to personnel is substantially reduced.

There is no one best IVC system currently available. The decision about which system to purchase and use will continue to be institution-dependent and will relate to a number of factors that vary from institution to institution. Technology will continue to advance and new and better IVC systems will be offered by the industry.

Robert E. Faith, DVD, PhD, DACLAM

Faith Consulting LLC

Oconomowoc, Wisconsin

USA