Low-Cost Class 100 Clean Room

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THIS REPORT DESCRIBES the evaluation of a mass air displacement clean–room unit (See Fig. 1). This unit costs substantially less than other preassembled commercial units. It suitably provides economical, quality space for viral antibody–free animals.

Materials and Methods
The BioBubble® Clean Room is simply constructed of an aluminum tubing frame with a heavy-duty, tear-proof vinyl skin. The vinyl has a 20-year life span. A high efficiency particulate air (HEPA) filter comes to you preassembled.

To evaluate our clean room, we constructed it in an animal room. Within the room, there was sufficient space for a six-shelf rack 60 in. long, 30 in. wide, and 72 in. high. We received 20 virus antibody–free female Sprague Dawley rats weighing 175–200 g each. We housed these rats, two per cage, in 19 in. long, 10.5 in. wide, 8 in. deep polycarbonate cages with stainless steel tops. We used hard wood bedding in these cages. We autoclaved the food, cages, bedding, water bottles, and water before using them.

We housed ten of the rats in the portable clean room, and ten outside the unit in the same animal room. Whenever we handled the rats, we wore sterile gowns, gloves, and masks. The animal room was environmentally controlled at 22±2°C and 50±5% humidity with 12 hours of light every 24 hours. We wanted to keep the noise level in the clean room below 85 dB, so we measured the noise level at a height of 3 ft. off the floor with a #1565–B sound level meter.

We performed all our manipulations of the rats housed in the clean room unit while we were in the unit.
We collected 1.5 ml of blood from all 20 rats in order to quantitate sialodacryoadenitis (SDA) antibody titers. Using an enzyme immunosorbtant assay, we discovered that all 20 rats had negative SDA antibody titers. To test the effectiveness of our portable clean room, we intranasally inoculated two of the rats housed outside the unit with a $10^5$ median tissue culture infective dose (TCID$_{50}$) of SDA virus. We then observed all the rats daily for clinical signs of SDA infection. Forty–five days after we exposed the rats to the SDA, we used cardiac puncture to bleed them, and then tested for SDA antibody titer.

We performed a particle count using a Met One Model 200 clean room monitor. We used the monitor to count the number of 0.3 micron particles per ft.$^3$ in the filter output duct (immediately downstream from the HEPA filter), the bottom of the clean room, and the animal room outside the clean room.

**Results**

Within two weeks of the SDA inoculation, we noticed that 80% of the rats housed outside the clean room showed clinical signs of SDA virus infection.$^3$ Forty–five days after we exposed the rats to the SDA virus, we found that all ten of these “outside” rats seroconverted and had positive SDA antibody titers. The ten rats that we housed inside the clean room showed no clinical signs of infection, did not seroconvert, and remained SDA virus antibody–negative.

The sound level meter readings revealed that on the A scale, the highest noise level inside the clean room was 67 dB, and the lowest level was 64 dB. On the C scale, the highest noise level was 77 dB, and the lowest was 71 dB. We determined that the noise level was satisfactory for this type of environmentally controlled space.

We discovered, by using the clean room monitor, that the filter output duct had an average of 12 particles of 0.3 micron per ft.$^3$. The bottom of the clean room averaged 48 particles of 0.3 micron per ft.$^3$, and the area outside the clean room averaged 108,286 particles of 0.3 micron per ft.$^3$. These tests confirm that the portable clean room exceeds the specifications set forth by Federal Standard 209B as a class 100 room.

**Discussion**

It is essential to provide virus antibody–free animals with a quality environment that will maintain their microbial status. A clean room, which can provide such an environment, may be substantially costly. The unit described here is much less expensive because it uses commonly available, inexpensive materials, and because it can be assembled in the laboratory. With this unit, any researcher can create a mass air displacement laminar flow clean room with positive or negative pressure capabilities. As our investigations proved, our clean room provided a high quality environment that protected the animals housed within it from microbial contamination.

**References**


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