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Future-proofing animal facilities: Lessons from Flexible Room Model at top medical school in Asia

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Biosafety zoning in a flexible facility presents a genuine engineering challenge

When we designed the small animal holding facility in 2012, we were solving a problem most facility planners preferred to defer: **what happens when research needs change, but the walls cannot move?**

At the time, the question felt theoretical. Today, with biomedical research evolving rapidly — driven by the growth of contract research organisations (CROs), expanding cell and gene therapy pipelines, and a stronger focus on AAALAC-accredited facilities — the answer feels urgent. What we built over a decade ago now looks less like a bespoke solution and more like a blueprint.

The Problem with Fixed Rooms

The conventional animal facility is a collection of fixed commitments. A mouse room is a mouse room. A rabbit suite is a rabbit suite. Each is sized for a specific species, biosafety level and research programme.

That works when demand is stable. It rarely is. Size rooms too small, and you turn away researchers. Size them too large, and you pay for empty, conditioned space. When needs shift — from rodent studies to rabbit immunology, or from ABSL-1 to ABSL-2 — renovation becomes the only option, bringing downtime and disrupted research.

The Brief

The project gave us approximately 2,200 square metres of gross floor area to deliver a small animal facility capable of achieving AAALAC accreditation. The programme included mouse, rat, guinea pig and rabbit holding, procedure rooms and

support areas.

What was not standard was the ambition: to make the holding rooms genuinely flexible without sacrificing biosafety, animal welfare or AAALAC requirements.

The Architecture of Flexibility

Nine animal holding suites were created in three clusters. Rooms could function as holding or procedure spaces depending on demand. Two suites were designed for rabbits, with tighter humidity control at 50% ±5% relative humidity.

All holding rooms were sized and serviced for both Individually Ventilated Cage (IVC) racks for rodents and open-cage rack systems for rabbits. Interconnecting doors allowed rooms to be combined into larger suites or subdivided into smaller isolated zones. Sinks were portable rather than permanently plumbed.

Biological Safety Cabinets (BSCs) and Animal Transfer Stations (ATCs) followed the same approach: rooms were dimensioned and serviced to accommodate either, allowing operators to reconfigure as the programme evolved.

Solving Pressure First

Biosafety zoning in a flexible facility presents a genuine engineering challenge. A room that can operate at ABSL-1 positive pressure one month and ABSL-2 negative pressure the next requires airside infrastructure capable of both states from the outset.

We addressed this with bubble-tight dampers on supply and return ducts, air-tight sliding doors between zones, and a centralized rack blower system serving all IVC racks. Thimble connections allowed rack blower connections to change without permanent ductwork modification.

The facility could support multiple simultaneous pressure regimes. One cluster could run at ABSL-2 negative pressure while adjacent clusters continued ABSL-1 positive pressure rodent holding. Zonal isolation protocols also meant a health event in one suite could be contained without shutting down the entire facility.

The AAALAC Dimension

Flexibility does not mean designing loosely. AAALAC accreditation requires consistent performance, including appropriate temperature and humidity, ventilation, lighting cycles, species-appropriate space allowances, and strict separation of clean and dirty workflows.

The design was validated against these requirements in every configuration. The facility achieved AAALAC certification within its first year of operation, with no major defects identified at third-party commissioning. Pre-COVID utilization rates ran at 70–75%.

Why This Matters Now

The research landscape across Southeast Asia has shifted considerably since 2012. The growth of CROs and biotech startups across Malaysia, Indonesia, Singapore and beyond has increased demand for shared, flexible animal research infrastructure.

These organisations often lack the certainty to justify a purpose-built fixed facility. They need space that scales with research, accommodates multiple species and biosafety levels, and supports AAALAC-quality work. At the same time, construction costs and land scarcity mean every square metre must earn its place.

Three Principles to Take Away

Looking back from 2026, this facility validates three principles.

Design for the future, not for today. The research programme in year one is rarely the one you will be housing in year five. Build for a range of possibilities.

Solve pressure first. Airside infrastructure is the hardest thing to modify after construction. If ductwork, dampers and airflow logic can support multiple pressure regimes from day one, everything else can follow.

Write the SOP before opening the door. A flexible facility only delivers its potential if operators understand how to reconfigure it safely. Procedures for zone changes, pressure transitions and species switchovers should be drafted during design, not improvised after handover.

This facility was forward-thinking in 2012 because it refused to predict the future and instead prepared for multiple futures simultaneously. Across Southeast Asia and beyond, that idea has well and truly come of age.

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