ALAT CHAPTER 7

The Laboratory Animal Environment

EVERY STEP OF THE WAY

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ENVIRONMENT

Appropriate to the Species

Surroundings known as the laboratory animal environment

Located in a building or wing

- **Research laboratories**
- **Offices**
- **Lab animal facility**
  - **Animal rooms**
  - **Cage wage**
  - **Offices**
  - **Locker and showers**
  - **Storage**
  - **Surgery suites**

Indoor environmental conditions

- Controlled and monitored
  - Temperature
  - Humidity
  - Noise
  - Air Exchange

Outdoor environmental conditions

- Protection from
  - Heat
  - Cold
  - Other environmental extremes

ENVIRONMENT

Macro vs Micro

Macroenvironment:

- Temperature
- Humidity
- Ventilation
- Light intensity
- Light duration
- Noise
- Odors

Microenvironment

- Animals Cage environment
  - Temperature
  - Humidity
  - Ventilation
- Affected depending upon type of caging
  - microisolator cage vs individually ventilated racks

ANIMAL ROOMS

Temperature

Temperature

- Stress can occur when the room is to hot or too cold
- Breeding rooms suitable for neonates 72°F/ 22°C
- Warm rooms
  - Newly hatched chicks
  - Piglets
  - Post op surgery/recovery
- Cooler rooms for rabbits and dogs
- Rooms exceeding 80°F/26°C may cause animals to suffer heat stress.

Table 7.1. Recommended dry-bulb temperatures for common laboratory animals

Animal	°C	°F
Mouse, rat, hamster, gerbil, guinea pig	20–26	68–79
Rabbit	16–22	61–72
Cat, dog, nonhuman primate	18–29	64–84
Farm animals and poultry	16–27	61–81

Table reprinted with permission from the *Guide for the Care and Use of Laboratory Animals*, 8th edition, 2011. National Academy of Sciences: National Academies Press, Washington, DC.

ANIMAL ROOMS

Humidity and Dust

Humidity

- Measure of the amount of waster in the air
- Acceptable range is 30%-70%

Dust

- Hazard to workers
- Organisms can attach and affect animal health

Ventilation

- Rate at which room air is exchanged with fresh air
- Adequate exchanges help
    - Prevent increased CO_2 and Ammonia levels
    - Maintain humidity and temperatures

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ANIMAL ROOMS

Ventilation

Ventilation

- Rate at which room air is exchanged with fresh air
- Adequate exchanges help
    - Prevent increased waste gases
    - Maintain humidity and temperatures
    - 10-15 times per hour
    - Reduce odors
    - Prefilters can help reduce microorganisms

Positive or negative pressure

Number of air exchanges depends upon many factors

- Species
    - # animals in room
    - Size of animals
- Type of housing
- Type of bedding used

Rodents

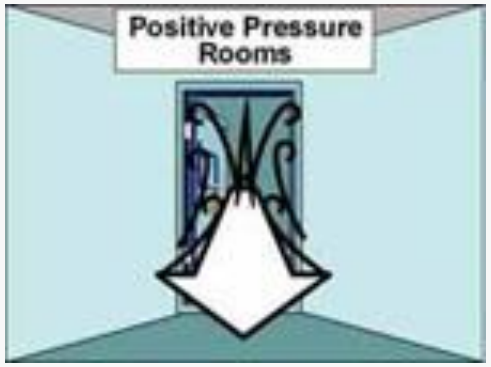
- Housed in a microenvironment
- Room parameters maybe quite different for each type of cage
    - Microisolators
    - IVC racks

ANIMAL ROOMS

Positive or Negative Pressure

Positive Pressure

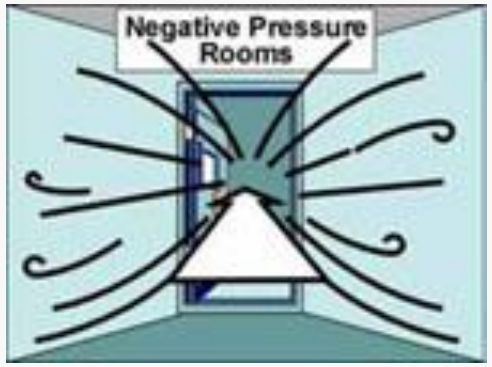
- More air is pumped into room that is pumped out
  - Raises the air pressure in the room
- Air flows out of room into hallway
- Prevents contaminants from entering room
- Surgical suites
- Barrier rooms



Air from room flow to hallway
Surgical suites, barrier rooms

Negative Pressure

- More air is pumped out of room than pumped in
  - Lowers pressure in the room
- Air flows into the room from the hallway
- Prevents contaminates from escaping room
- Quarantine rooms
- Hazardous agent rooms



Air flow from hallway to the room
Quarantine, hazardous agent rooms

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LIGHTING

Illumination

Even distribution

Bright enough for daily work

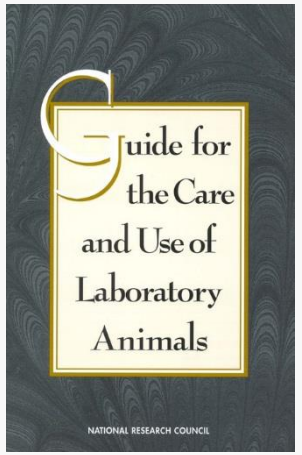
Change in lighting and light cycles stressful

Excessive bright lights problematic for albinos

Light and dark cycles

- Most common
  - 12 hours of daylight
  - 12 hours of darkness
- Alternative cycles
  - 14 hours daylight
  - 14 hours dark

Natural light can affect cycles



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NOISE, VIBRATIONS, ODORS

Stressors to the Animals

Reduce noise around animals

Exposure to high levels can induce stress

House rodents and rabbits away from busy areas

Speak in soft tones in animal rooms

Equipment may emit high frequency sounds

Vibrations can cause disturbances in animal rooms

Odors can affect animals

Can cause distress in the animals

Strong room odors need to be reported

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MONITORING SYSTEMS

Back up Power

Emergency Back up Power

- Essential to a lab animal facility
- Ensures animals' well being

Environmental Monitoring Systems

- Light
- Temperature
- Humidity
- Air Pressures.

ANIMAL ROOM DESIGN

Ideal Conditions

- Easy cleaning of surfaces
- Non slip flooring
- Drains with slotted covers

Water Proof

- Floors
- Walls
- Ceilings
- Illumination
- Electrical outlets

Pest proof

BARRIER FACILITIES

Bioexclusion and Biocontainment

Bioexclusion

- Prevents entry of adventitious agents
- SPF animals
- Ventilation is positive pressure

Biocontainment

- Prevents pathogens from being released
- Animals infected with a biohazardous agent
- Ventilation is negative pressure

Sterilization of supplies

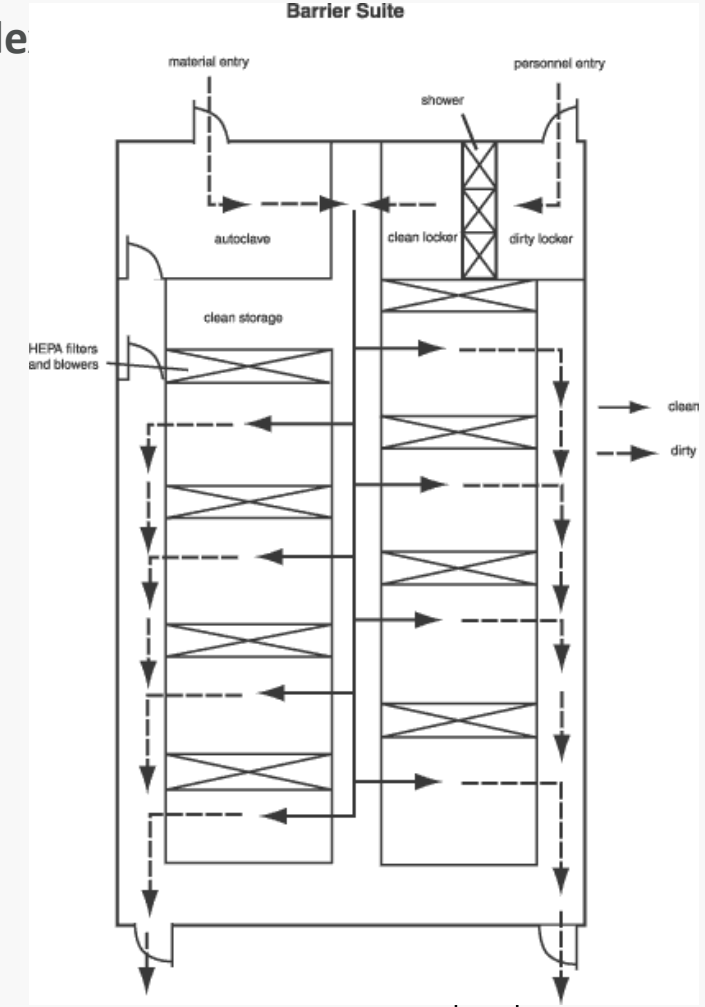
PPE appropriate for the room

HEPA filtered air

Barrier can be simple or comple

Traffic patterns

- Enter on clean site
- Exit on dirty side



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QUARANTINE AND ISOLATION ROOMS

Quarantine

- Rooms separate incoming animals form animals already in the facility

Conditioning

- Allows time for animals to adjust to new surroundings

Isolation

- Suspected sick animals
- Housed separately
- Negative pressure rooms

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FEED AND BEDDING

Purchase from reputable vendors

Stored separately in designated rooms

- Vermin proof
- Dry area
- Up and off the floor
- Temperature regulated
- Rotate inventory
- Special feeds stored separately

ADDITIONAL ROOMS

Equipment Storage

Personnel Areas

Procedure Rooms

Surgical Suites

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SUMMARY

A laboratory animal facility must safeguard both the welfare of the animals and the integrity of research

Environmental fluctuations or infections can affect the animals and thus invalidate the research project.

Changes in environmental conditions may necessitate termination of a study

The result is a new study thus using more animals and resources which can impact 3R's and the cost of research

ALATs are the first line of defense against disruptions in the environmental controls of a facility

A constant effort to observe and monitor the environment will help to produce high quality research

QUESTIONS?

Additional Readings

Centers for Disease Control and Prevention and National Institutes of Health [Internet]. 2007. Biosafety in microbiological and biological laboratories (BMBL), 5th ed. [Cited 20 Jan 2009]. Available at http://www.cdc.gov/OD/ohs/biosfty/bmbl5/bmbl5toc.htm.

The Guide For The Care and Use of Laboratory Animals. 2011, 8 th edition ,Institute of Laboratory Animal Research. Washington (DC); National Academies Press.