

Space Descriptions



*Vivarium
NIH Design Policy and Guidelines*

The first three sections describe the planning requirements for the animal-housing, procedure, and support zone, which at the NIH has three categories: housing/holding areas, special-purpose spaces, and office and shared-use areas. The fourth section describes the planning requirements for the spaces in the transitional zone, and the fifth section describes the planning requirements for the administration and management support zone. For specific requirements refer to section E, Room Data Sheets.

C.1 Housing/Holding Areas

In designing spaces, it is essential to plan for anticipated species usage and caging type. The housing or caging system is one of the most important. It should be carefully designed to facilitate animal well-being; meet research requirements; minimize experimental variables; and be isolated from heat, vibration, and noise sources. The caging system should provide adequate space to permit freedom of movement and normal postural adjustments; a comfortable environment; and an escape-proof enclosure that confines animals safely with easy access to food, water, and ventilation. The caging system must also meet the biological needs of animals, e.g., maintenance of body temperature, urination. All holding rooms must be designed to be easily cleanable and minimize pest harborage. Consideration should be given to the accommodation of records and supplies.

The following diagrams depict the relationships of the functional areas for animal housing/holding.

Diagram No. 2 illustrates a typical large animal-holding room with an optional ante room. A central aisle space allows caretakers to easily access all cage racks. The optional anteroom provides necessary space for caretaker procedures and helps prevent possible animal escape.



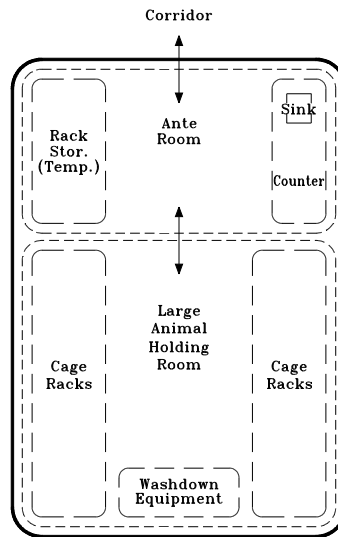


Diagram No. 2

Diagram No. 3 illustrates a typical small animal-holding room with rack placement on either side of aisle space. The washdown equipment shown is optional for small animal rooms.

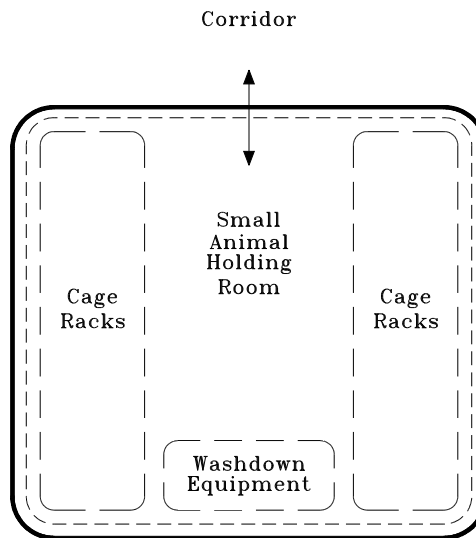


Diagram No. 3



In the case of some large animals, consideration may be given to provision of natural light, adequate exercise, group housing, means for animal communication, and well-equipped play areas with toys, games, and televisions. This must be undertaken without sacrificing safety, and might depend upon the nature of the research.

C.1.1 Small Animals

Small-animal rooms may house mice, rats, hamsters, guinea pigs, and rabbits. Each species must be held in separate rooms or cubicles. As an option ventilated racks can be used to house rodents in order to provide separation of animals at the rack or cage level. Each rack should provide for either bottle or automatic watering systems. An additional option small-animal rooms is the use of biological safety cabinets (BSCs) as a change hood or for noninvasive procedures. Space should be considered for a separate anteroom that can be used for minor procedures or housing of additional racks.

C.1.2 Large Animals

The large-animal rooms may house cats, nonhuman primates, and dogs. Since large animals may be noisy, they should be distant from quieter areas of small-animal rooms, administration spaces, and research laboratories. Space should be provided for caging with a separate anteroom that could be used for prep, minor procedures, and sample collection. Anterooms are also recommended to minimize the potential of releasing escaped animals into the rest of the colony. Each cage should provide for either bottle or automatic watering systems. See the discussion of small-animal rooms above. Consideration should be given to self-cleaning drains. Dogs should be provided with runs if they are to be held for a long period of time.

Alternatives to individual caging for nonhuman primates are encouraged. Infants and juveniles can be housed in group cages. Space in group cages should be enriched with structures such as resting perches and shelters. Some species should be provided items for swinging or climbing.



C.1.3 Cubicle Housing

Cubicles are rooms within a room. A higher level of protection can be attained through the provision of individual air supply and exhaust in each cubicle. Air may pass through a high-efficiency particulate air (HEPA) filter at the supply, exhaust, or both. Cubicles offer the advantage of isolating a small segment of the animal population and permit housing of multiple species in a single room. Cubicles are particularly useful for quarantine of incoming animals and may preclude the need for a separate quarantine room. Cubicles are also useful in the containment of hazardous substances used in animal studies, provide an added degree of security, and reduce odors and allergens. Cubicles can be prefabricated units and can be readily disassembled to convert the room to other uses. Each cubicle may have its own exhaust, lighting, and watering system.



C.2 Special-Purpose Spaces

C.2.1 Procedure Rooms

Animal procedure laboratories may be either shared or dedicated. A shared procedure room provides space for working with animals from multiple animal rooms and frequently involves multiple investigators, and possibly more than one species. Dedicated animal procedure rooms provide space for working with animals maintained in a single room or a small cluster of animal rooms which may have direct access to the procedure laboratory without using the corridor. Procedure rooms may be equipped with a fume hood and/or BSC, stainless steel counters with downdraft sinks/tables, exam lights, and wall-mounted cabinets.

C.2.2 Containment Suites

For specific requirements refer to the Center for Disease Control and Prevention (CDC) and the NIH guidelines for biosafety level (BL) planning and design. As a minimum, all laboratories at the NIH are designed as BL2 facilities.

C.2.3 Surgical Suites

Functional areas for surgery should include a surgical support area, an animal prep area, a surgeon prep area, operating room(s), and intensive care and treatment rooms. The surgical suite should be located away from high-traffic corridors and potential sources of contamination such as cage wash, necropsy, and waste storage. Ideally, separate locker, housekeeping, and toilet facilities should be provided in close vicinity of the surgical suite. Surgery for small animals may be conducted in the procedure rooms or in operating rooms.

Diagram No. 4 shows the internal relationship of animal preparation, operating, and recovery rooms as well as the relationship of scrub, surgical supply and work, and operating rooms.



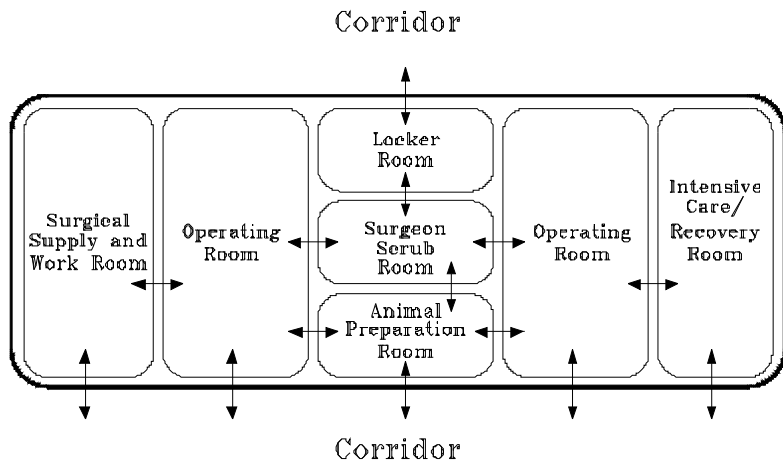


Diagram No. 4

Locker Room: This area provides space for surgical personnel to change before and after surgery. Lockers should be provided for short-term storage of personal items. Consideration should be given to planning a janitor's closet (with a floor-mounted mop sink) and a toilet room in this area.

Surgeon Scrub Room: This room provides space for surgical personnel to clean up before and after surgery and will have direct access to the operating room. It may have direct access to the animal prep room. It will be equipped with a scrub sink and disposable scrub brush dispenser.

Animal Prep Room: This area provides space for holding and preparing the animal subject for surgery. It should have direct access to the operating room and may have direct access to the scrub room. The prep room will be equipped with a procedure table, storage cabinet, stainless steel counter, and sink with wall cabinets. Vacuum should be provided at the procedure table to remove hair resulting from shaving animals.

Operating Room: This area provides space for surgical procedures on animals. Survival and terminal operating rooms should be designed the same and used interchangeably.

Intensive Care/Recovery Room: This area provides space for animals recovering from surgery and the effects of anesthesia. It will house a cage or rack and be equipped with stainless steel



counter, sink, and wall cabinet. Medical gases and suction may also be needed.

Surgical Supply and Surgical Work Room: This room will provide space for surgical supplies and work space. It should have direct access to the operating room and the corridor. It will be equipped with lockable casework, sink cabinets, and sterilizers. The room is organized with unidirectional flow from dirty to clean. Cleaning equipment such as sinks, washers, ultrasonic cleaners, and autoclaves are accessed from the dirty side, with instrument pack, prep, and storage on the clean side, toward the operating room.

C.2.4 Pharmacy

A pharmacy area shall be provided in the vicinity of the procedure room and surgery suite. It should contain an appropriate level of security for a drug vault.

C.2.5 Radiographic Suite

The radiographic suite consists of a darkroom, control booth, and radiographic room. It should be located convenient to the surgical suites.

Diagram No. 5 shows the relationship of X-ray equipment to operator control booth and X-ray film processing equipment in the dark room. The X-ray equipment, animal subject, and entry should be visible from the control booth.



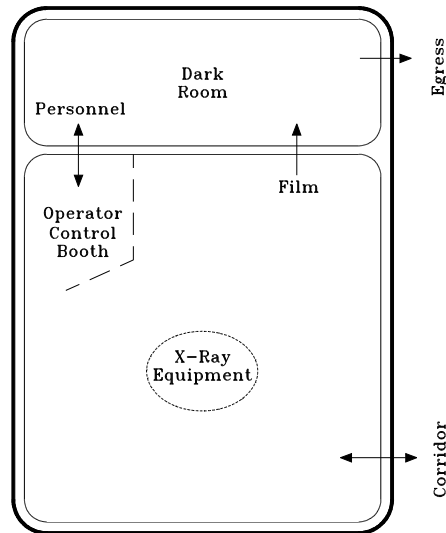


Diagram No. 5

Darkroom: The darkroom provides space for developing X-ray film and houses an automatic film processor or developing tanks, sink, film bin and light-tight loading bench, countertop, red light, and wall-mounted film illuminators. The room must be equipped with a lightproof door and a warning sign. An electronic interlock should be provided that prevents the red light from lighting and entry door from opening while the film bin is open.

Control Booth: This booth provides protective space for personnel to control the X-ray unit.

Radiographic Room: This room provides space for X-raying animal subjects and will house a radiographic and fluoroscopic X-ray unit with table, wall-mounted film illuminators, and wall-mounted storage cabinets. Specialized power requirements of the individual machine must be taken into account in the design of power distribution.

Shielding of all walls and door must be provided in accordance with the NIH Division of Safety. An electronic interlock system between the X-ray equipment and entry door lock will be as follows:

- The electric lock is activated by X-ray equipment.



- X- ray equipment shall not operate unless the entry door is closed and locked.

The NIH Radiation Safety Branch should review and approve all design documents and inspect all construction relative to the radiographic equipment.

C.2.6 Diagnostic Laboratory

Diagnostic laboratory services supplement the treatment area and facilitates diagnosis of disease. The services may include gross and microscopic pathology, clinical pathology, hematology, microbiology, clinical chemistry, and other appropriate laboratory procedures. The space will be equipped with corrosion-resistant countertops with an integral sink, and casework. Outlets for gas, air, and vacuum shall be provided.

C.2.7 Necropsy

This area provides space for examining deceased animals. It is equipped with a downdraft table (sized for species held in the facility), a stainless steel counter and sink with wall cabinets, and a fume hood. Provisions should be made for carcass storage, either a refrigerator/freezer or, for large animals, an adjacent walk-in refrigerator.

C.2.8 Animal Treatment Room

This room is provided to examine or treat sick and injured animals. It will be equipped with an exam table, exam light, refrigerator, casework, etc. Also, a procedure room can be designated for this function.

C.2.9 Receiving and Examination Room

This space is used to examine new animals prior to placing them in quarantine. The space should be located between receiving and quarantine and shall be equipped with an exam table and exam light. Caretakers in rodent receiving areas may use temporary isolation cabinets to separate animals from different sources.



C.2.10 Quarantine Area

Most incoming animals will be quarantined prior to entering the animal-holding area. Self-contained cubicles will be used for small animals held in the facility. Each cubicle may have its own exhaust, watering, and waste system.

C.2.11 Vestibules

Vestibules should be located as required to prevent contamination of animal-holding areas and clean areas of the vivarium, for sound isolation, and for security. Doors are to be equipped with bristle-type door sweeps. Consideration should be given to provisions for visitors to gown/degown at entry vestibules.

C.2.12 Cage Wash

Depending on the species housed in the facility, cage-wash areas may contain a bottle washer, a cage and rack washer, tunnel-type washers, and an autoclave. Cage and rack washers feature a chamber of sufficient size to accommodate one or more cage racks or large cages. The rack washer should be placed in a pit to eliminate the need for ramps. Pits must be easily accessible and cleanable. Separate pits shall be designed for equipment pit(s) and drip pit(s). Grating-covered drip pits should extend into the clean area to allow the clean rack to drip dry (provide separation between the dirty and clean pits). The tunnel washer transports cages on a continuously moving conveyor through a pre-rinse, detergent wash, rinse, final freshwater rinse, and drying sequence. These units are also suited for water bottles, small cages, and other small equipment. During the planning phase the method and route of bedding disposal for small animals should be defined from cage wash to loading dock. Acid neutralization, depending on the size of the facility, may be required and should be considered during the planning phase.

Diagram No. 6 illustrates the flow of cage racks into the dirty area through washing equipment in the equipment area and into the clean area where they can be staged for the holding rooms or stored in clean cage storage. Also, material such as soiled bedding is eliminated in the dirty area, while fresh bedding is inserted in the clean area.



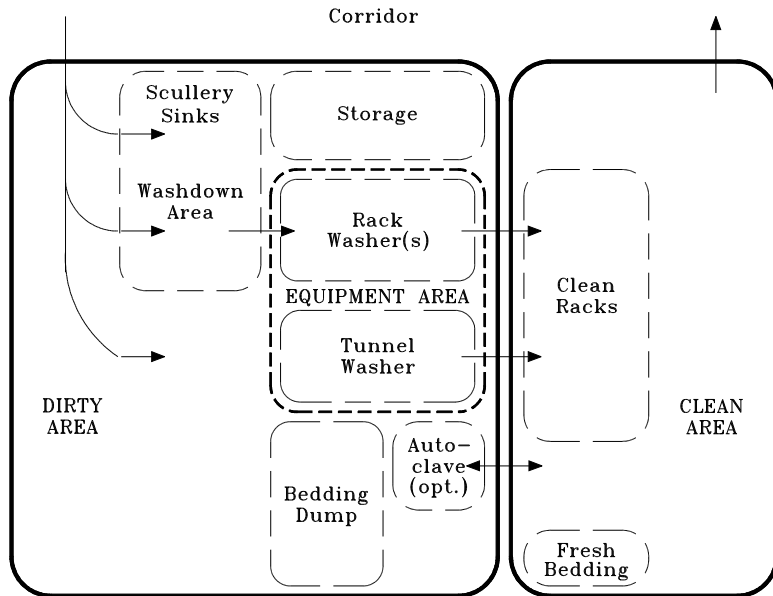


Diagram No. 6

The need for tunnel washers in addition to cage and rack washers is driven by species housed, capacity of the facility, number of wash cycles per week, number and duration of staff shifts, and redundancy/capacity of other washers.

The cage-wash area should be divided into two areas, a "dirty" area and a "clean" area. A third area called "equipment" containing the wash equipment, between clean and dirty, should be considered in large cage-wash operations. It should be sized by the number of rack and cage washers used and the number of racks washed per cycle.

The dirty area may be equipped with a scullery sink, dump station, slurry equipment, automatic water manifold flush station, prewash stall, and emergency eyewash and shower. The dirty area must allow for washdown activities. The clean area is equipped with an autoclave, bedding dispenser, drinking-water flush station, and feeder bottle filler. The provision of a single-fixture (unisex) toilet room should be considered in both dirty and clean areas. The equipment pit should be sealed, and the space around the washing equipment should be sealed to form a complete barrier between the clean and dirty sides of the cage-wash area. The cage wash should be convenient to animal holding but distant from administration offices and personnel areas. Both sides should be designed to promote proper cleaning and minimize pest harborage.



All materials and finishes should be moisture resistant, sealed, and caulked. Finishes in the dirty area should stand up to high-pressure water cleaning.

C.2.13 Storage

Adequate storage space must be planned for clean cage racks, bedding, any special clothing and supplies, cleaning chemicals, husbandry supplies, and procedure room supplies. Wire-bar shelving is recommended.



C.3 Office and Shared-Use Areas

C.3.1 Offices

Animal care and use is typically contracted out at the NIH. The contractor supervisor must have at least one office.



C.4 Transitional Zone

C.4.1 Break Areas

Rooms shall be provided in the transitional zone so animal care workers may have access to coffee, refrigerators, etc. without entering the administration area of the vivarium. Break rooms are essentially lounges and serve as interaction space for the vivarium staff. They shall be located in the vicinity of the administration area and changing areas, have a comfortable atmosphere, and be equipped with chairs, tables, bookcases, counter, microwaves ovens, white boards, and tack boards.

C.4.2 Other Support Space

Locker, toilet, and shower rooms shall be provided for gowning prior to entering animal-holding areas and degowning after leaving the animal-holding areas. These rooms shall be equipped with individual lockers for staff. These spaces must be designed and constructed using moisture-resistant materials and wall-hung fixtures to allow for ease of cleaning.



C.5 Administration and Management Support Zone

C.5.1 Administration Areas

Administration offices should be located near the vivarium entrance. This locates the supervisory veterinarian in a position to observe the movement of personnel and equipment into or out of the facility. From this position, visitors may have access to the administrative functions without going into the animal housing and support areas. Clustering administration offices, lockers, toilets, showers, and break areas provides the opportunity for isolation from potential contamination.

C.5.2 Offices

Private offices shall be provided for the branch chief and veterinarians, wherever possible. Open office space is provided for clerical and other administrative personnel. Appropriate provision shall be made for privacy. Ergonomic systems furniture shall be used in all administration spaces.

C.5.3 Conference Rooms

Small conference rooms should be provided for formal and informal meetings of staff and for periodic training. Conference areas shall be utilized on a shared basis and be designed in accordance with National Fire Protection Association (NFPA) occupant loads.



C.6 Building Operational Areas

For specific requirements regarding building operational areas including circulation and loading docks and receiving refer to the Research Laboratory Design and Policy Guidelines.

