Guide for

LABORATORY ANIMAL FACILITIES AND CARE

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
The Animal Care Panel is a nonprofit educational association of individuals and institutions concerned with the production, care, and study of laboratory animals. The entire United States and several foreign countries are represented in its membership.

The Panel provides for the exchange of scientific information on all phases of laboratory animal care. It compiles and distributes information on films dealing with the handling of laboratory animals, and has initiated an animal technicians’ training program. It publishes a bimonthly journal, “Laboratory Animal Care;” sponsors annual awards designed to encourage and reward outstanding accomplishment in the improvement of the care and quality of laboratory animals; and maintains close liaison with the Institute of Laboratory Resources (National Research Council), the American Veterinary Medical Association (through the American College of Laboratory Animal Medicine), the Laboratory Animal Breeders Association, and the National Society for Medical Research.

Through its Animal Facilities Standards Committee, the Panel gathers and examines information that will aid in the establishment of high standards for the care of animals.

Guide for

LABORATORY ANIMAL
FACILITIES AND CARE

Prepared by the
ANIMAL FACILITIES STANDARDS COMMITTEE
of the
ANIMAL CARE PANEL

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Preface

This Guide is intended to assist scientific institutions in providing the best possible care for laboratory animals. The recommendations are based on scientific principles and on expert opinion and experience with methods and practices which have proved consistent with high quality care.

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Introduction

Laboratory animal medicine has experienced dramatic growth in recent years. This growth is a natural consequence of the increased financial support of medical research, of the consequent increase in the numbers of animals used, and of the great refinement in research techniques which requires better quality animals and animal care. Proper use of the Guide should aid institutions in protecting their great investment in laboratory animals and facilities, and in improving these facilities.

The Guide is symbolic of the scientific community’s ethical commitment to provide the best possible care for animals used in the service of man and animals. The recommendations are based on three principles:

1. The care and management of laboratory animals should be directed by professionally qualified persons.
2. All animal care personnel should be suitably qualified by training and experience in the care of laboratory animals.
3. Physical facilities and the methods of care for animals should permit their maintenance in a state of well-being and comfort.

The Committee recognizes that the nature of the animal facilities and the methods used in implementing these principles may vary with the type and size of the scientific institution. However, it hopes the Guide will serve as a common reference for all institutions conducting animal care programs.

The first edition of the Guide is directed primarily to the problems of maintaining the most commonly used mammalian species in medical research institutions. It may contain errors of omission and commission. Corrections will be received gratefully, and the Committee solicits constructive criticism. If the Guide is to serve usefully, it must be a living document, subject to change with changing conditions and new information.

The Committee wishes to emphasize that nothing in the Guide is intended to limit the investigator’s freedom and obligation to plan and conduct animal experiments in accordance with accepted practice. The proper scientific control of certain experiments may require modification of parts of the Guide in the interest of the research. However, the Committee believes that the routine operation of institutional animal facilities should be guided by these recommendations.
I. Personnel

A. Professional direction of laboratory animal care

The attainment of the highest possible animal care standards depends primarily on the individual(s) directing the program(s). An institution may need one or several "directors of animal care," depending on its size and on the administrative organization of its animal facilities. However, the objective should be to provide a professional staff adequate in size to assure responsible direction of laboratory animal care.

1. Laboratory animal facilities should be directed by professionally qualified persons having at least 3 years of pertinent training, experience, or combination of training and experience.

2. As used here, pertinent training means the completion of a period of formal graduate professional or academic training in laboratory animal medicine, or a related field. Pertinent experience means the completion of a period of active participation or apprenticeship at increasing levels of responsibility, in the operation of laboratory animal facilities. The broad subject areas in which directors of laboratory animal facilities should be knowledgeable include:

   (a) methods and techniques of laboratory animal care, handling and experimentation;
   (b) comparative anatomy, physiology, pathology, and diseases of laboratory animals;
   (c) administration and management of laboratory animal facilities.

3. Persons professionally qualified to direct laboratory animal facilities include:

   (a) Diplomates of the American College of Laboratory Animal Medicine (see app. I, p. 26);
   (b) physicians, dentists, veterinarians, or other persons formally trained in the biological sciences, and having at least 3 years of pertinent training, experience, or combination of training and experience;
   (c) persons who do not have professional or academic degrees; but who are qualified by virtue of having specialized education, training, and experience essentially equivalent to categories 3(a) and 3(b) above. Ordinarily, however, such persons would be expected to serve under professional direction.
Animal care standards devoting the program(s). An organization of its animal care, training, and direction of laboratory personnel.

1. Animal care personnel should be suitably qualified by training and experience in the care of laboratory animals. Scientific institutions should make provisions for the training of newly employed animal care personnel.

2. Qualified animal care personnel include:
   (a) persons certified by the Animal Technician Certification Board of the Animal Care Panel (see app. II, p. 27);
   (b) persons having training or experience essentially equivalent to that required for Animal Care Panel certification.

3. Apprentice personnel should be supervised directly by qualified personnel (2(a) or 2(b) above) or by the professional director of animal care.

4. The size of the animal care staff should be adequate to assure daily attention to the needs of the laboratory species, in accordance with the recommendations in the Guide.

5. Provisions should also be made for personnel to provide emergency care of animals whenever needed.

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1 Training courses in laboratory animal care are offered in many communities through the local branches of the Animal Care Panel. For further information write the Executive Secretary, Animal Care Panel, Box 1028, Joliet, Ill.
II. Physical Plant

The physical condition and design of animal facilities determine the efficiency and the economy of their operation, and greatly influence standards of animal care. A well designed facility, properly maintained, is an essential element in good animal care.

It is likely that many new animal facilities will be built in the next few years, and significant remodeling of existing quarters will occur. Thus, the question of what constitutes proper facilities for laboratory animals is an important one. In most institutions a research building is the product of many compromises, and it is not always possible to provide ideal solutions for inherently difficult design problems. Nevertheless, careful planning can help to minimize these problems. This section of the Guide deals with design and construction features which must be considered in the planning and operation of animal facilities.

A. Functional areas

The ultimate design, scope, and size of an animal facility depend on the nature of the research activities, the number of animals to be housed, and the geographical relationship to the rest of the institution. The following functional areas are considered essential in a modern animal facility:

1. A separate building(s); a separate wing; one or more floors; or separate rooms where animals can be housed apart from areas of human occupancy. A sufficient number of animal rooms or areas are required to assure separation of species or isolation of individual projects; to provide for the receiving, quarantine, and isolation of animals; and to provide for their routine and specialized housing.

2. Specialized laboratories or areas contiguos with or near the animal housing areas for activities such as surgery; necropsy; intensive postsurgical care; roentgenography; preparation of special diets; and for diagnosis, treatment and control of laboratory animal diseases.

3. Receiving and storage areas for food, bedding, supplies, and equipment.

4. Office(s) for administration, supervision, and direction of the facility.

5. Showers, sinks, lockers, and toilets for personnel.

6. Area(s) for washing and sterilizing equipment and supplies. A well equipped cleaning area includes facilities such as a cage washing
machine; bottle or glassware washing machine; rack washing machine or area; waste can washing machine or area; utility sink(s); autoclave(s) for equipment, food, and bedding; and separate areas for holding soiled and clean equipment.
7. Incinerator capable of burning all animal waste and refuse; or facilities for safe and sanitary storage of such waste prior to removal.

B. Service areas in relation to total size of the animal facilities
1. An area or areas equal in square feet to at least 25 percent of the animal housing space should be set aside for the service functions of the animal facility. The service functions include activities such as cage washing and sterilization; storage; diagnostic laboratory; office activities; receiving and quarantining of animals; and refuse disposal.
2. Where an animal facility is 1,000 square feet or less in size, it may be possible to carry out the service functions in an area(s) which serves other activities in the building as well. However, a separate facility for washing and sanitizing animal cages should be available.
3. In a facility up to 10,000 square feet in size, separate rooms or areas should be provided for the following service activities:
   (a) Receipt and quarantine of newly purchased animals.
   (b) Receipt and storage of animal food and supplies, including refrigeration.
   (c) Cleaning and sanitizing of cages and equipment.
   (d) Incinerator or protected area for refuse.
   (e) Lavatory facilities for personnel.
   (f) Office(s) for supervisory and administrative personnel.
   (g) Laboratory for director.
4. In institutions having several separate animal housing facilities, or one large area, which total more than 10,000 square feet, rooms or areas for all of the service functions listed in item 3 above should be provided. In addition, diagnostic facilities or services for animal diseases should be provided (sec. III.D., p. 22). Some duplication of service areas may be required if the animal facilities are widely dispersed. However, if they are physically centralized such duplication can be minimized.

C. Geographical relationship of animal facilities to research or teaching laboratories
Animal housing areas support research and teaching laboratories. Good animal husbandry and human comfort require physical separation of animal facilities and human occupancy areas such as offices and laboratories. This can be accomplished by locating the animal quarters in a separate wing or on separate floors of a multistory building, or by providing a separate building(s) for animal housing. A one-story building for animal housing permits the most efficient and
economical animal care operation since vertical transport is avoided. However, it may be least desirable for research workers because of in-accessibility to their laboratories. Efficiency and economy in utilization of the research workers' time must be considered in planning animal facilities. Careful planning should make it possible to locate the animal areas adjacent to or near laboratory areas, but physically separated from them by barriers such as double door entries, separate corridors, or separate floors.

D. Materials

Materials used in animal quarters should be equal to or superior to those used in laboratory areas. They should conform to all applicable building codes. Maintenance costs as well as initial construction costs should be considered in selecting building materials; and materials should be selected which will facilitate efficient and hygienic operation of the animal quarters. Durable, waterproof, fire resistant, seamless materials for interior surfaces are most desirable. Paints and glazes should be highly resistant to chemical solvents, cleaning agents, and scrubbing.

E. Corridors

Corridors should permit easy flow of personnel and equipment; a width between 5 and 8 feet is recommended. The floor-wall junction should be coved to facilitate cleaning. A curb or guard railing should be provided to protect walls from gouging by racks and carts. Exposed corners should be protected by reinforcing with steel or other durable material up to a height of 4 feet. Corridors leading to dog kennels should be provided with a noise trap such as a double door entry lock. Wherever possible, access to utilities such as waterlines, drainpipes, and electrical connections should be through service panels or shafts located in the corridors outside of the animal rooms.

F. Animal room doors

Animal room doors should open into the rooms, not into corridors. They should be at least 3 feet wide to permit easy passage of racks and equipment. Metal or metal covered doors are preferred. They should be equipped with kickplates and be self-closing. Recessed handles are recommended. Viewing windows are desirable. Door frames should be sealed completely to prevent their serving as vermin traps.

G. Exterior windows

Exterior windows in animal rooms are unnecessary. If windows are provided they should preferably be nonopening, of a thermopane construction (in areas of temperature extremes), and sealed with a
material which will withstand repeated washing and disinfection. If windows are opened for ventilation purposes, effective screening is essential.

H. Floors

Floors should be smooth, waterproof, nonslip, wear resistant, and capable of carrying racks and equipment without gouging or pitting. Depending upon the functions carried on in specific areas, terrazzo, cupric oxychloride cement, smooth hard surfaced concrete, quarry or ceramic tile, neoprene terrazzo, special hardened rubber base aggregates, vinyl or vinyl asbestos tiles, are satisfactory. Asphalt or other absorbent materials are not satisfactory.

The piercing of waterproof floor membranes in animal rooms should be avoided. If an object does pierce the membrane, a continuous membrane flashing should be provided around this object to a height above the contiguous floor surface.

I. Walls

Walls should be waterproof, painted, glazed or smooth, free of cracks or imperfect junctures at the floor, ceiling, corners, or utility penetrations. Materials should be acid or solvent resistant, capable of withstanding scrubbing with detergents and disinfectants. Glazed structural masonry, ceramic tile, or cold glaze over masonry are preferred. Painted plaster or panel-type construction may be satisfactory under some conditions, but a lack of structural rigidity may lead to the breaking of any seal provided by paint or glaze.

J. Ceilings

Ceilings formed by the concrete floor above are satisfactory if properly smoothed, sealed, and painted. Furred ceilings of plaster or fire code plasterboard should be sealed and painted with washable finish. Hung ceilings of absorbent or acoustical materials, or even ceilings perforated for the diffusion of heat and air, are not objectionable provided the space above is maintained free from vermin. Exposed pipes and fixtures at ceiling level are undesirable in simian prime mate rooms because of the problems created should monkeys escape from their cages.

K. Ventilation, temperature and humidity control

1. Effective ventilation is necessary to maintain a low concentration of atmospheric contaminants such as odors or pathogenic organisms, to regulate room temperature, and to promote comfort. Factors of importance in proper ventilation are temperature, humidity, and the movement of air.
2. If animals are housed outdoors with no access to indoor facilities, provisions to aid their natural temperature regulation are essential. When the ambient temperature falls below 60° F., some form of shelter and clean nesting materials should be provided. Materials such as shavings, straw, paper, or rags can be used. When the ambient temperature exceeds 85° F., animals should be able to burrow, or lie on materials several degrees cooler than the surrounding air; or effective shade should be available.

3. A mechanical ventilation system is necessary in most indoor facilities. Air conditioning is highly recommended since it promotes environmental stability. Ideally, the ventilation system should permit individual adjustments within ±2°F. for any temperature within a range of 65° to 85° F. Relative humidity should be maintained within a range of 40 to 60 percent. The animal facility and human occupancy areas should be ventilated separately. The system should provide frequent changes of room air without drafts. A minimum of 10 to 15 changes per hour are recommended. There should be no recirculation of room air. Temperature and humidity should be controlled individually in each animal room. An acceptable alternate is to provide area control with limited recirculation of room air. A general area operation at 74°±3° F. and 50±10 percent relative humidity, using 100 percent fresh air during temperate weather and 50 percent fresh air during periods of temperature extremes is acceptable for situations where routine housing of animals is the primary requirement.

4. Maintenance of a given room temperature within even closer tolerances such as ±1° F., and of relative humidity within 5 percent, using 100 percent fresh air at all times, may be required for certain experiments. For example, where precise environmental studies are in progress, such controls may be essential. In such rooms recording devices for temperature and humidity should be installed, together with a failure alarm system.

5. Provision for air dilution (general ventilation), exhausting of room air, and air movement is essential in maintaining a low concentration of atmospheric impurities in animal rooms, and in accelerating evaporative heat losses beneficial to comfort.

The concentration of odors or hazardous particles is not reduced efficiently simply by dilution due to an increase in air changes per hour. A more effective procedure is to remove the source of contamination from the animal room.

In a room having no forced ventilation, where circulation depends on the gravity of air of different humidity and temperature, at least two ventilation openings are necessary. They should be situated in opposite sections of the room, one higher than the other. At least 1 square foot each of air inlet and outlet should be provided for each 20 dogs, 80 cats, 400 rats, or 4,000 mice.
In heated, but not air-conditioned facilities, a minimum of 10 to 15 air changes per hour should be provided. During summer as many as 30 changes per hour may be required. However, no evaporation or heat reduction takes place in saturated air whose temperature is higher than an animal's body temperature, regardless of the velocity of air.

In air-conditioned facilities 8 to 15 air changes per hour are considered adequate for comfort. Rapid motion of air to provide evaporative cooling is more efficiently achieved by the use of auxiliary fans moving the air within the space than by an increase in the number of conditioned air changes. The ability to maintain odor free facilities depends upon the number and species of animals housed and on the sanitation practices as well as on the ventilating system.

I. Power and lighting

The electrical system should provide ample lighting, sufficient power outlets, safety provisions such as high sparkproof outlets in rooms where volatile, explosive anesthetics may be used, and waterproof outlets where water is used in cleaning.

Lighting should be uniformly diffused throughout the area to be served. Although 10 to 15 foot-candles of light are considered sufficient to maintain vital animal activity and rhythms, at least 30 foot-candles are necessary for ordinary servicing of animal rooms. For most animal housing areas, a lighting intensity of 35 to 50 foot-candles at the level of the cage racks is recommended. Animal treatment and examination areas should have a minimum of 50 foot-candles at the work surface.

Recessed fluorescent lamps, sealed within the ceiling, are excellent. Incandescent or fluorescent lamps in tightly sealed fixtures hung from the ceiling are adequate. No covers should be placed on light fixtures unless they are properly sealed, to prevent their serving as vermin traps.

Adoption of a standard daylight equivalent is recommended in windowless animal facilities. This can be accomplished by providing a centrally controlled, timed, off-on lighting system; or by attaching a simple timer to the light switch in each animal room.

Provision should be made for emergency lighting and power in the event of a power failure.

M. Drainage

All waste fixtures and equipment should be connected through traps to soil and waste pipes and to the sewer. If floor drains are used the drainpipes should not be less than 4 inches in diameter. In heavy use areas such as dog kennels, 6-inch diameter drains are recommended. A flushing drain, much like an ordinary toilet bowl set
in the floor, is an effective aid in the disposal of solid waste. A porous trap bucket to screen out solid waste provides an effective alternative to removal of solid materials through the drain. All drainpipes should have short runs to the main, or they should be steeply pitched from the opening. When drains are not in use they should be capped and sealed to prevent backflow of sewer gases. Lockable drain covers are useful in preventing use of the drains for disposal of materials which should be swept up and removed by other means.

Floor drains are not essential in animal rooms for species such as rats, mice, or hamsters. Floors in such rooms can be maintained satisfactorily by wet vacuuming, or by sweeping and mopping with appropriate disinfectants or cleaning compounds. If drains are used, the floor should pitch towards the drain about 1 inch in 12 feet. Proper pitching of the floor is an essential element in establishing good drainage in animal rooms; and particular attention should be paid to this detail in planning animal facilities.

N. Storage areas: Food and bedding; refuse; equipment

In areas where delivery schedules are reliable, the amount of space required for food and bedding storage can be held to a minimum. The best utilization is achieved by maintaining constant turnover so that stored items are always “fresh.”

Bulk supplies of food and bedding should not be stored in animal rooms. A separate area(s) or room(s) should be available in which food and bedding can be stored off the floor on pallets, racks, or carts. A continuing pest control program is essential; but it is most desirable to have the storage areas rodent-, fly-, and vermin-proof.

Food storage areas should be physically separated from refuse areas. Temperatures in the storage rooms may be the ambient temperature. However, it is good practice to hold packaged animal feeds (pellet rations) at 50°F or less. Refrigerated storage should be available for meats, fruits, vegetables, and other perishable items.

Refuse storage areas should preferably be kept below 45°F, to reduce putrefaction of waste or animal carcasses. Obnoxious materials should be covered or packaged. The area should be constructed so it can be kept clean and free of rodents, flies, and vermin.

Dead storage and equipment storage does not require special mention except to indicate that availability of such space is essential in preventing “clutter” in animal rooms.

O. Noise control

Noise is inherent in the operation of animal facilities, both from the animals and animal-care routines. Noise may be undesirable because of its effects on personnel, and on the animals themselves. Inasmuch as background and “operational” noise is an environmental
factor in the control of animal experiments, it should be considered in the design of animal facilities.

Ordinarily, species such as rats, mice, guinea pigs, and hamsters, do not create disturbing noise in animal facilities. Cats and chickens are seldom a problem. Noise from a monkey colony can be troublesome. However, dogs invariably are the cause of unwelcome noise. Barking is disturbing to personnel working inside and out of the animal facilities. It may also pose important public relations problems if residences are near the laboratory.

The physical separation of human and animal occupancy areas is the best way to minimize disturbances to laboratory personnel from the sounds of animals and animal-care routines. Within animal facilities noisy activities such as cage washing and refuse disposal should be carried out in rooms or areas separate from the animal housing areas. Unwelcome noise from animal-care routines can be minimized by appropriate indoctrination and training of personnel; by using rubber tired casters and rubber bumpers on carts, trucks, and racks; and by removing major cage-cleaning activities from animal rooms to areas specifically designed for this purpose.

The use of sound reducing materials in animal rooms can be helpful. Concrete walls are more effective than metal or plaster walls in containing sound. Acoustical materials may be used in animal rooms by direct application to the ceiling, or as part of a suspended ceiling, providing the rooms are vermin-proof. Elimination of windows also helps to contain sound.

Where dogs are housed outdoors such as on the roof of a building, barking sounds can be directed upward by appropriate baffling of the surrounding parapet area. This procedure is helpful only when there are no taller buildings nearby.

P. Facilities for washing and sterilizing equipment and supplies

An area for washing and sterilization is essential to keep equipment physically clean, to reduce obnoxious odors, to minimize the spread of infectious diseases, and to provide for the comfort of experimental animals. The washing and sterilizing activity is best conducted outside of the animal rooms in an area(s) specifically designed for the purpose. Consideration should be given to factors such as:

1. Location with respect to animal rooms, traffic flow, elevators, and ease of access.
2. Soundproofing.
3. Facilities such as hot and cold water, steam, floor drains, and lighting.
4. Proximity to cage and equipment storage areas. It is good practice to provide separate holding areas for soiled and clean equipment.
5. Insulation of walls and ceilings where necessary.
6. Ventilation with installation of proper vents and provisions for dissipation of steam.

The use of an animal cage-washing machine is highly recommended unless disposable cages are used. The machine should provide both wash and rinse cycles, preferably with flexible time settings for each. An automatic detergent dispenser is recommended. Either the wash or rinse cycle, or both, should be conducted at not less than 180° F. to assure destruction of all pathogenic organisms except spore formers. Cultures of “cleaned” cages should be taken periodically to assure the adequacy of the washing routine. A properly functioning machine should render the equipment essentially sterile. In practice, all soiled cages should be considered potential sources of organisms infective for animals in the colony.

If no machine is available, hand washing of small cages can be accomplished in a large sink or tub, using appropriate detergents, disinfectants, and vigorous scrubbing.

Large pieces of equipment may have to be washed by hand. However, portable cleaners which dispense detergent and hot water or steam under pressure may be helpful. Some institutions use a booth in the cage-washing area for rack washing. Such an area serves well when equipped with hot and cold water, steam, and a detergent dispenser. It should be specially vented to exhaust the steam. Where the size of the animal facility warrants the investment (generally in facilities larger than 10,000 square feet), a large washing machine for racks, dog cages, and similar large pieces of equipment is useful.

A bottle-washing machine is recommended if large numbers of water bottles are used (generally in facilities larger than 10,000 square feet). Some cage-washing machines may also be used for this purpose. If bottles are washed by hand, powered rotating brushes located at the washing sink are useful. If hand washed, provision should be made for dipping or soaking water bottles in detergent and disinfectant solutions. A two-compartment sink or tub for this purpose is adequate.

An autoclave for equipment and supplies in the cage-washing area is recommended. Use of an autoclave for animal cages is essential where pathogenic agents are under investigation (sec. Q, p. 13.) In certain specialized facilities such as in production colonies of caesarean derived, defined environment animals, autoclaving or other forms of sterilization of food and bedding may be necessary. However, routine sterilization of food and bedding is not considered essential if care is taken to use clean materials from reliable sources.
Q. Special facilities needed for biological safety in infectious-disease units

The materials used in the construction of infectious disease units and other animal facilities are similar. However, in the design of infectious areas, the need for effective isolation is obviously of greater importance; especially where diseases transmissible to man are under investigation. An infectious disease unit should be separate from holding areas for normal animals. The unit should be close to or part of the laboratory where the work is being done; either in a separate building or in an isolated part of a larger building.

Several special facilities should be incorporated into infectious-disease units to aid in the protection of personnel and to prevent cross infection among animals in the colony:

1. Separate locker rooms for the storage of clean street clothing and the removal of contaminated laboratory clothing, with a shower in between.
2. Air lock entry to the infectious disease unit; preferably with an ultraviolet light barrier within the lock.
3. Autoclave(s) to sterilize cages, bedding, watering devices, feeders, and waste before cleaning or removal. Some institutions place double door autoclaves in a wall between the animal room and the cage-washing room or corridor. This makes it possible to sterilize equipment and supplies entering or leaving the room, and establishes a flow system from “contaminated” to “clean.” Automatic interlocks may be used to prevent the door on the clean side from being opened until a sterilization cycle is completed. If equipment is sterilized before it leaves the infectious disease unit, it may be washed in a machine serving other areas. However, in large units, a separate washing area should be provided.
4. Animal rooms in infectious disease units should be ventilated under negative pressure with respect to corridors or adjoining non-infectious areas. Ten to fifteen changes per hour of conditioned air generally are sufficient for all needs. There should be no recirculation of room air in infectious areas.

Coarse filtration of the supply air (bacterial filtration efficiency of 20 to 50 percent) may be needed if there is a significant load of pollen, mold, dust, or smoke in the outside air.

Exhaust air from the units should be filtered. Spun-glass filters having an efficiency of 99 percent or greater are recommended. It is important that the filter frame be sealed tightly in the plenum chamber to prevent leakage of unfiltered air. Electronic precipitation is effective but the maintenance cost of this system is high. Frequent servicing is necessary to maintain rated filtration effectiveness. Incineration is another effective air treatment system. However, it is expensive, except when the volume to be incinerated is small (75 to
90 cubic feet per minute or less). Large oil- or gas-fired incinerators are feasible to sterilize large volumes of air containing highly infectious organisms. Ordinarily, incineration of air is unnecessary, except in the highest risk areas, such as when dangerous aerosols are used.

5. Special rack and caging systems may be helpful, depending on the organism under study and the mode of exposure of the experimental animals. Ultraviolet lamps and reflectors have been found helpful in controlling airborne spread of infections between cages. They should be attached in a horizontal position at both ends of each cage rack shelf to provide a band of radiation across the top of the cages. The radiations are effective in reducing the escape of airborne vegetative organisms from animal cages. They are not as effective against bacterial spores. Ultraviolet lamps should be effectively shielded to protect animals and personnel from eye damage. Protective goggles for personnel are recommended.

Several types of ventilated cages are available. Ventilated cages are useful where airborne organisms are under investigation. Ventilated lids can be made to fit ordinary animal cages. This entails the use of airtight gaskets around the rim of the lid, an exhaust pipe which can be connected to a central exhaust system, and an air intake equipped with a Fiberglas filter. More complex units such as Horsfall cubicles or flexible film isolators may also serve usefully for this type of work.

6. Ventilated cabinets or hoods are recommended for the inoculation of animals with infectious organisms and for necropsy of infected animals. These should be equipped with viewing windows, glove ports, lights, and service piping for gas, air, water, and vacuum. A 250-cubic-feet-per-minute air filter to exhaust air from the cabinet will serve effectively except for the most hazardous types of infectious disease research. With this system a high velocity airflow into the cabinet is essential for safety.

7. Disinfectant vaporizers are helpful in decontaminating an animal room following conclusion of experiments and removal of all animals. The room should be sealed, 1 milliliter of 37 percent formaldehyde should be vaporized for each cubic foot of airspace, and allowed to act for 6 to 8 hours. Room temperature should be at least 70°F. and relative humidity 80 percent during the decontamination procedure. Beta propiolactone, used in the same way as formaldehyde in a concentration of 300 milligrams per cubic foot, is also an effective air and surface decontaminant.

Ancillary facilities such as sinks and hose bibs in rooms housing infected animals are recommended to facilitate cleaning and disinfection.
Special requirements for radiation safety

Radiation safety is a fundamental obligation in housing radioactive animals. Where hazardous radionuclides are used, provision must be made for the protection of personnel and of animals not involved in the experimental program.

1. An area(s) should be provided for housing radioactive animals apart from other experimental animals. This may be done by holding such animals in well ventilated hoods designed for this purpose, or by treating the entire holding room as a hood. If high levels of gamma emitters are to be used (100 to 1,000 megacycles), the base of the hood should support lead shielding weighing approximately 1 ton. The rate of airflow in the hood should be 50 to 80 linear feet per minute. Service outlets should be located outside of the hood to reduce exposure and spread of contamination.

2. To protect against radioactive contamination of animal rooms, all surfaces should be nonporous and easily washable. Cracks and crevices should be sealed. Strippable materials applied to walls and floors are recommended. Rubber or vinyl tiles, or linoleum, applied over a concrete floor will provide adequate protection since these materials are nonporous and can be lifted if necessary. Epoxy resin paints or surfacing materials will seal plaster walls effectively if properly applied.

3. To facilitate decontamination, stainless steel is recommended for animal cages and sinks in preference to galvanized steel, porcelain, or soapstone. Rough surfaces such as nonsmooth welds, which are difficult to decontaminate, should be avoided.

4. Work surfaces such as benchtops and the interior of animal-holding hoods should be covered with strippable coatings. These will protect the surfaces adequately when low levels of activity are used (up to 2 megacycles of activity). Where radioactivity levels are intermediate or high, stainless steel trays should be used to cover the bench top and floor of the hood.

5. Personnel must be protected during animal injection procedures. Syringes should be covered with a plastic shield when using up to several milliecs of beta emitters. For injection of low levels of gamma emitters, the syringe should be covered with lead or steel shields. However, for higher levels the entire operation should be performed by remote control. Similarly, remote control devices are recommended for oral administration of highly radioactive materials.

6. Facilities for disposal of radioactive animal waste:
   (a) Radioactive wastes may be diluted with the air by release in hood effluents. Volatile wastes in combustible materials may be released by incineration, providing insoluble particulates of high specific activity are not permitted to escape in the effluent. Incineration also is a means of reducing the bulk
of nonvolatile materials to about 20 percent of their original weight. Small numbers of animals containing small amounts of radionuclides are readily disposed of by incineration. Large numbers may require concentration by incineration or other means, followed by special disposition, such as deep burial or disposal at sea.

(b) Liquid and water soluble waste can usually be disposed of by dilution in the sewer system. When this method of disposal is used, the possibility of re-concentration within the diluting medium must be considered as well as the expected dilution within the sewer system. The quantities disposed of should be controlled so that hazards are not presented to sanitation and sewage plant personnel.

(c) Storage facilities for radioactive animal carcasses and excreta should be provided until the activity is reduced sufficiently for disposal by dilution, or until they can be disposed of as ordinary stable wastes. Such wastes should be monitored by the institutional radiation safety officer. Special shielding of the storage area may be required. To minimize waste control and disposal problems, the smallest animal capable of fulfilling the experimental requirements should be used.

(d) Mechanical washing equipment should be of a type which will facilitate decontamination of cage equipment and will not itself accumulate radioactive waste. For example, radioactive cages should not be washed in machines which recirculate the wash solution.
III. Laboratory Animal Housing and Care

Comfortable housing is another essential element in good animal care. Comfort depends on a variety of subjective and objective factors which interact differently in different institutions. Accordingly, it is impossible to develop a single definition of comfortable housing which is applicable to all institutions. Experienced animal-care workers know that the well-being of animals is not entirely dependent on a modern physical plant and the newest housing equipment. Well-trained personnel frequently can overcome physical deficiencies to assure high quality animal care. Therefore, for the purposes of the Guide, comfortable housing is defined as any system of management, care, and housing which permits animals to grow, mature, reproduce, and behave normally in the laboratory, and to be maintained in good health. Some of the specific considerations which give meaning to this definition are outlined in this section.

A. Housing

1. Criteria for evaluating a caging or housing system

The caging or housing system perhaps is the most important single element in the physical environment for laboratory animals. Inasmuch as the well-being of the animals and the control of experiments are influenced by this environmental factor, the housing system should always be designed with care. The adequacy of any caging or housing system may be evaluated on the basis of the following criteria:

(a) The system should meet the investigator’s research requirements. Thus, animals may need to be housed singly or in groups; in cages, runs, or pens.

(b) The system should be designed with the animals’ physical comfort as a primary consideration. Rarely are the requirements of research incompatible with physical comfort.

(c) Physical comfort, as applied specifically to the housing system, includes factors such as keeping the animal dry and clean; maintaining the animal in a state of relative thermal neutrality; providing sufficient space to assure freedom of movement; providing convenient access to food and water, and assuring their delivery to the animal in a clean form; and, if animals are group housed, maintaining them in compatible groups and avoiding overcrowding.
(d) The system should be compatible with the maintenance of the animals in good health. Factors such as maintenance of normal body weight and ability to prevent spread of communicable diseases among adjoining housing or caging units are important.

(e) The system should be designed to facilitate effective sanitary maintenance and technical servicing. For example, bends and crevices in animal cages, which may be difficult to clean, should be avoided; the system should be capable of easy and complete cleaning; feeders and watering devices should be easily accessible for filling or changing.

(f) Cages, runs, and pens should be kept in good repair to prevent injury to the animal(s) and to promote physical comfort. Particular attention should be paid to avoiding sharp corners and edges or broken wires; and maintaining cage floors in good condition to prevent the animals' feet from being cut or caught.

2. Exercise

One of the most widely debated questions in the field of animal care concerns the need for "exercise" in the housing of laboratory animals, most specifically in the housing of dogs. The concept of "exercise" frequently is confused with that of cage size by animal welfare groups. A "small" cage is equated with lack of "exercise" and physical discomfort; while a "large" cage, a pen, or a run is equated with "exercise" and physical well-being. Scientists know that the size of the cage does not necessarily influence the amount of "exercise" an animal receives, or its well-being. Nevertheless this semantic confusion about "exercise" is widespread and widely fostered by some lay groups. The general public is undoubtedly interested in this question, as evidenced by efforts of proponents of Federal legislation to regulate animal experimentation, to incorporate an "exercise" requirement in the proposed laws. A rational approach to this question is possible only in the framework of a specific definition.

For the purposes of the Gum "exercise" is defined as any physical activity calculated to restore, maintain, or improve vigor and health. On this basis, whether animals are "exercised," and what form it should take, is a matter of professional judgment which is best left to the director of animal care. If exercise is needed it may be provided in any of several ways such as by use of a treadmill or exercise wheel, by walking animals on a leash, by providing access to runs, or by releasing animals from their cages in the animal room.

With respect to the routine housing of dogs there are practical reasons for providing pens, runs, or other "out of cage" space in addition to individual cages. Cages are necessary and useful for intensive
postsurgical care, for isolation of sick animals, for metabolic studies, and for short-term holding of dogs (1 to 3 months). On the other hand, if animals are held for longer than 3 months, their physical comfort can be maintained more easily if runs or pens are provided. Runs or pens also provide a convenient place in which to hold dogs while their cages are cleaned. When dogs are allowed out of their cages regularly, sanitary maintenance of the cages is simplified. Finally, the availability of runs or pens makes possible the housing of dogs in compatible groups.

To summarize, whether animals should receive exercise as a routine aspect of housing, is a matter of professional judgment. Whether animals should be housed in cages or runs also is a matter of professional judgment, based on the previously mentioned criteria for evaluating animal housing systems. As a practical matter, however, there are reasons for providing both cages and pens or runs in the routine maintenance of dogs in the laboratory.

Similar considerations should apply in evaluating the need for “exercise” by other species.

3. Space recommendations for laboratory animals

The size of a cage, pen, or run, and the number of animals to be housed in each, are matters of professional and scientific judgment. The recommendations below are arbitrary; but they represent the best judgment of experienced animal-care workers as to a reasonable space allocation for the routine, long-term housing of animals of the weights indicated in table I. They are included here simply as a guide, and their incompleteness is acknowledged. As has been stressed in this section, the adequacy of any housing system must be evaluated in each institution by the professional director of animal care in terms of the previously mentioned criteria.

B. Sanitation practices

1. Cleanliness

(a) The animal facility should be kept clean. This means that a regular schedule of sanitary maintenance is necessary.

(b) Animal rooms, corridors, storage areas, and other parts of the animal facility should be washed, scrubbed, vacuumed, mopped, or swept, using appropriate detergents and disinfectants, as often as necessary to keep them free of dirt, debris, and harmful contamination. A continuing objective should be to keep these areas neat and uncluttered.

(c) If litter or bedding is used in animal cages or pens, it should be changed as often as necessary to keep the animals dry and clean, and to minimize offensive odors. For simple maintenance of small rodents such as rats, mice, or hamsters, 1 to 3 such changes per week ordinarily should suffice. For larger species
such as dogs, cats, and simian primates, daily changing of cage or pen litter may be necessary.

**TABLE 1.—Suggested space for the routine housing of laboratory animals**

<table>
<thead>
<tr>
<th>Species</th>
<th>Weight</th>
<th>Type of housing</th>
<th>Overall size (inches)</th>
<th>Number of animals</th>
<th>Housing area/animal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Width</td>
<td>Depth</td>
<td>Height</td>
</tr>
<tr>
<td>Dog</td>
<td>15 kg</td>
<td>Pen</td>
<td>48</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 kg</td>
<td>Run</td>
<td>48</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 kg</td>
<td>Cage</td>
<td>48</td>
<td>144</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 kg</td>
<td></td>
<td>36</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>30 kg</td>
<td></td>
<td>48</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>Simian primate</td>
<td>4-5 kg</td>
<td></td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Cat</td>
<td>4 kg</td>
<td></td>
<td>18</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Rabbit</td>
<td>4 kg</td>
<td>Group cage</td>
<td>36</td>
<td>48</td>
<td>72</td>
</tr>
<tr>
<td>Guinea pig</td>
<td>320 g</td>
<td>Individual cage</td>
<td>8</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Rat</td>
<td>250 g</td>
<td>Individual cage</td>
<td>8</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Group cage</td>
<td>14</td>
<td>Small group cage</td>
<td>8</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Mouse</td>
<td>20 g</td>
<td>Large group cage</td>
<td>12</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>Chicken</td>
<td>3 kg</td>
<td>Individual cage</td>
<td>38</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Group cage</td>
<td>38</td>
<td>24</td>
<td>18</td>
</tr>
</tbody>
</table>

1 As a further general guide the cage dimensions should be: (a) The height of the dog at the withers plus at least 6 inches (height). (b) The length of the dog from the tip of the nose to the base of the tail plus at least 6 inches (width or depth).

(d) Cages or pens from which animal waste is removed by hosing or flushing should be cleaned daily or oftener. This system may require removal of the animals during servicing in order to keep them dry.

(e) Animal cages, racks, and accessory equipment such as feeders and water bottles, should be washed and sanitized as often as necessary to keep them physically clean and free of harmful microorganisms. Ordinarily, this can be achieved by washing the cages and accessories once or twice weekly, and the racks every other week. In addition, cages should always be sanitized before new animals are placed in them. It is good practice to have extra cages available at all times to permit maintenance of a systematic cage-washing schedule. To reiterate a point made in section II.P. (p. 11), the washing or rinsing, or both, should be conducted at a temperature of 180° F. or higher to assure destruction of all pathogenic organisms except spore formers. If this temperature cannot be attained, washing of equipment should be followed by appropriate disinfection, using an effective disinfectant.

(f) Waste containers and implements should be maintained in a sanitary condition. It is good practice to wash each waste can every time it is emptied. As with animal cages, the minimum wash or
states, daily changing of cage
insects, daily changing of cage

Table 2. Housing of laboratory

<table>
<thead>
<tr>
<th>Height (inches)</th>
<th>Number of animals</th>
<th>Housing area/animal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>2</td>
<td></td>
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<tr>
<td>44</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

The height of the dog at the withers plus at the nose to the base of the tail plus at least 180'

One of the first steps toward keeping laboratory animals healthy is to remove by hosing or scrubbing with a non-sterilizing detergent. This system may require increased attention to the servicing in order to keep

Equipment such as feeders and drinkers should be sanitized as often as necessary and as often as possible. Sanitation to be effective must be carried out in the same manner as that described for cleaning of cages and the racks every other day. Sanitation of cages and the racks every other day should be done. The racks should be removed before cleaning to prevent the possibility of introducing diseases. The racks should be sanitized before being replaced in the cages.

This practice is of the utmost importance in the control of diseases such as tuberculosis; and for the prevention of other communicable diseases.

The maximum processing time for any piece of equipment, such as cages, should be 180° F. Similarly, cleaning implements such as scrapers, shovels, and mops should be sanitized regularly.

2. Sanitary waste disposal

(a) All waste should be collected and disposed of in a safe, sanitary manner. If waste cans are used, they should be made of metal or plastic, be leakproof, and equipped with tight-fitting lids. It is good practice to use leakproof disposable containers such as plastic bags or lined paper bags in conjunction with waste cans, for disposal of animal tissues and carcasses.

(b) Highly infectious wastes should be rendered noninfectious, by autoclaving or other effective means, before removing them from the animal facility.

(c) Waste materials should be removed on a regular, frequent schedule. If storage of waste prior to removal is necessary, the holding area should be physically separate from other storage facilities, and free from flies, cockroaches, rodents, and other pests.

3. Vermin and rodent control

(a) Cockroaches, flies, bedbugs, escaped or wild rodents, and similar pests, constitute a menace in any animal facility. Their elimination or effective control should be considered mandatory.

(b) Freedom from these pests can be assured in new construction by careful inspection of the building before it is occupied. Effective control, and ultimate elimination, can be attained in older buildings, even where heavy infestation has occurred. This can be accomplished by sealing or eliminating all breeding sites, and by using pesticides or trapping procedures in conjunction with a strict program of sanitary maintenance.

4. Personal hygiene

(a) The maintenance of high standards of personal cleanliness among animal colony personnel is obligatory. Comfort facilities necessary to meet this obligation should be provided.

(b) To aid in maintaining a high standard of personal hygiene, laboratory clothing suitable for use in the animal facility should be provided. This clothing should be changed as often as necessary to enable personnel to maintain a neat and clean appearance. Lockers or other suitable facilities should be available for storage of street clothing during the workday.

(c) Personnel working in animal facilities should receive regular physical examinations including appropriate diagnostic tests for diseases communicable between laboratory animals and man such as tuberculosis; and protective immunizing agents such as tetanus toxoid.
C. Feeding, watering and identification of laboratory animals

1. Feeding

All laboratory animals should have access to feed daily according to their particular requirements. The food should be clean, free of contaminants, palatable, and nutritious. It should be fed in amounts sufficient to assure normal growth in immature animals, and maintenance of normal body weight in adults.

2. Watering

All laboratory animals should have access to water daily, according to their particular requirements. Ordinarily, drinking water should be available at all times. Watering devices such as drinking tubes and spouts, and automatic waterers should be examined routinely to ensure their patency.

3. Identification

Laboratory animals should be identified by appropriate means such as by placing identification cards in the animal rooms, on cages, or on the racks; by use of collars or bands on the animals, or by other appropriate means. Identification cards should include items such as the name and location of the responsible investigator, and any special instructions to animal-care personnel concerning the animals.

D. Diagnosis, control, and treatment of animal diseases

1. All laboratory animals should be observed frequently for clinical signs of illness, injury, or abnormal behavior by a person capable of recognizing such signs (see sec. I, p. 2). Clinical signs of illness include debility, anorexia, weight loss, listlessness, diarrhea, cyanosis, dyspnea, and similar indicators. It is good practice to observe dogs, cats, and simian primates daily for such signs; and other species at least 1 to 3 times weekly under ordinary circumstances. All deviations from normal, and deaths from unknown causes, should be reported promptly to the person responsible for animal disease control.

2. Professionally qualified persons should direct the control and treatment of nonexperimentally induced animal diseases and other abnormal conditions (see sec. I, p. 2).

3. Animals which develop abnormalities, rendering them unsuitable for laboratory purposes while in such conditions, should be treated or painlessly killed.

4. To facilitate proper diagnosis of abnormal conditions, laboratory facilities or services should be available for diagnostic procedures. These include facilities or services for the physical examination of animals and for necropsy; for histological and pathological examination of animal tissues; for handling, isolating, and identifying specific pathogens (viral, bacterial, mycotic, and parasitic); for routine and specific laboratory procedures (hematology, roentgenography, urinaly-
umption of laboratory animals

1. Food. The basic principle success to feed daily according to appetite; food should be clean, free of defects. It should be fed in amounts suitable to the size and activity of the animals, and maintained a full amount of drinking water daily, according to the activity of the animals, or by other appropriate means such as drinking tubes and maimed. All animals should be examined routinely to assess their health status.

2. Animal diseases. It should be observed frequently for clinical signs of illness (e.g., weakness, diarrhea, cyanosis, and so forth). Good practice to observe dogs, as well as any other species at risk. All deviations from normal should be reported to the proper individual.

3. Control of animal disease control. The director of animal care and other affected personnel should direct the control and care of animal diseases and other contagious conditions, rendering them unsuitable for further use. Normal conditions, laboratory procedures, and any diagnostic procedures, including the physical examination of the animals, are essential. The examination and pathological examination, and identifying specific diseases (e.g., bacterial or viral), for routine and special examinations, such as roentgenography, urinalysis, specific immunologic tests; and for inoculating test animals under suitable isolation conditions.

4. The general approach to the control and treatment of animal diseases and other abnormalities should include such factors as appropriate quarantine and isolation of animals (sec. III. E, below) control of animal quality by procurement from reliable sources (sec. III. E); proper sanitation practices in the animal facility (sec. III. B, p. 19); and specific procedures to break the disease cycle as directed by the person responsible for disease control.

E. Quarantine and isolation of animals

For the purposes of the Guide “quarantine” is defined as the segregation of newly received animals apart from animals already in use. “Isolation” is the segregation of animals suspected or known to be diseased, from animals which are in good health.

1. Newly received animals should be quarantined until their health status has been evaluated.

2. The duration of quarantine may vary according to the species used and the purpose(s) for which they are used. For species such as rats, mice, rabbits, and hamsters, when obtained from reliable sources, the quarantine may be limited to the time necessary for competent inspection. For these and similar species the control of quality at the source, and knowledge of the environmental history of the animals are effective adjuncts to quarantine within the institution. Where the environmental history of the animals is unknown, as is commonly the case with shipments of dogs, cats, and simian primates, a more complete quarantine should be employed, including procedures such as are recommended below. These procedures may take as little as 7 days or as long as 6 weeks to complete.

3. All animals should be inspected on arrival. If any animals are found to be in poor health, their management should be according to the recommendations in section III.D, page 22.

4. Animals intended for use in terminal studies, as in student demonstrations, should be clean and free of ectoparasites which may impair their health or comfort and render them unsuitable for such studies. It is good practice not to permit entry of such animals into the regular animal facilities prior to use.

5. Animals intended for use in long-term studies should be conditioned. At the discretion of the director of animal care, conditioning should include any or all of the following procedures:

(a) Physical examination of the animals on arrival, including any necessary clinical and laboratory diagnostic tests for communicable diseases.

(b) Veterinary care and treatment including removal of ecto- and endo-parasites, and other specific prophylactic or therapeu-
tic procedures, such as immunizations, as necessary to protect against communicable diseases.

(c) Adaptation to the laboratory diet, including supplemental feeding if necessary to restore normal body weight.

(d) Observation of animals within the quarantine area until their freedom from signs of communicable disease is assured.

(e) Grooming procedures such as bathing, dipping, drying, and clipping.

6. Should a nonexperimentally induced communicable disease(s) break out during the course of a study, the animal(s) involved should be isolated from animals which are in good health. Management of such diseased animals should be according to the recommendations in section III.D., page 22. It is good practice to provide a separate room for such animals, and to manage their care so as to minimize or prevent direct or indirect contact with healthy animals.

F. Animal surgery and postsurgical care

1. Facilities, equipment, and supplies

If surgery is performed, appropriate facilities and equipment should be provided. The area(s) should be operated in accordance with accepted surgical practice. Ordinary laboratory facilities can be utilized for nonsterile, terminal procedures, and for so-called “clean surgery” on small animals such as rats, mice, and hamsters. Aseptic surgery can be performed in a laboratory area if the laboratory is suitably prepared and equipped. However, if aseptic surgery is performed routinely, especially on dogs, cats, or simian primates, an area(s) specifically designed for this purpose should be provided. A well equipped area for aseptic surgery on these species should contain or have access to facilities, equipment, and supplies such as:

(a) An autoclave or other effective equipment for sterilization of instruments, linens, gloves, gowns, and similar items.

(b) Scrub sink(s) for surgical preparation.

(c) Operating tables, instrument stands, and tables.

(d) Operating light(s) of sufficient power to assure clear visualization of the operative field.

(e) Instrument and linen packs appropriate for each surgical procedure.

(f) Instruments and equipment for tracheal intubation and artificial respiration.

(g) Caps and masks for personnel during operative procedures.

(h) Kick buckets, laundry hampers, and other equipment as necessary for hygienic protection and maintenance.

(i) Whole blood, fluids, vasopressors, antibiotics, and other supportive drugs which may be needed during surgical procedures.
2. Operating rules

(a) A facility for aseptic surgery on dogs, cats, and simian primates should be directed by a professionally qualified person (see sec. 1, p. 1).

(b) Operating procedures for the facility should include provision for the proper preparation and anesthetization of animals for surgery, the setting up and maintenance of the operating area, and for other assistance needed by the surgeon.

(c) Anesthetization should include all necessary procedures and drugs for eliminating sensibility to pain during surgical procedures, as determined by the responsible investigator or the director of animal care.

3. Postsurgical care

(a) Provisions should be made for intensive care of dogs, cats, and simian primates during the postsurgical period. Intensive care includes procedures such as maintenance of adequate fluid balance; administration of whole blood, antibiotics, analgesics, or other drugs whenever indicated; recording rectal temperature; care of the surgical incision; emergency treatment; and similar clinical procedures. The duration of this period will vary with the type of surgery performed, and the condition of the animal. A one-week intensive care period is adequate to aid recovery from most surgical procedures.

(b) The intensive postsurgical care area(s) should be equipped for supportive treatment; or such equipment should be immediately available if needed. Heating pads or heated cages, steam vaporizers, compressed air, oxygen, examination table, and appropriate instruments, are examples of the types of equipment which may be needed.

(c) Laboratory facilities or services should be available as necessary to follow and support the animal(s') recovery.

(d) Similar care and facilities should be available as necessary to provide postsurgical care for smaller species such as rats, mice, rabbits, and hamsters.
Appendix I

PREREQUISITES FOR CERTIFICATION BY THE AMERICAN COLLEGE OF LABORATORY ANIMAL MEDICINE

The following prerequisites must be met to the satisfaction of the council of the American College of Laboratory Animal Medicine before a candidate will be certified as competent in laboratory animal medicine:

(a) Have satisfactory moral and ethical standing in the profession.
(b) Be a graduate of a school of veterinary medicine approved by the American Veterinary Medical Association.
(c) Have completed a comprehensive written examination.
(d) Have completed 2 years of postdoctoral training in laboratory animal medicine in a formal program approved by the College and have had 2 subsequent years of approved full-time experience in laboratory animal medicine; or have a master's degree in some area of biology or medicine and have had 4 years of approved full-time postdoctoral experience in laboratory animal medicine; or have had 6 years approved full-time postdoctoral experience in laboratory animal medicine.
(e) Have published, or presented in a form suitable for publication, a written dissertation on some phase of laboratory animal medicine.
(f) Have completed a comprehensive oral examination.

For further information write William C. Dolowy, D.V.M., Secretary-Treasurer, American College of Laboratory Animal Medicine, University of Illinois, 1840 West Taylor Street, Chicago 12, Ill.
Appendix II

PREREQUISITES FOR CERTIFICATION BY THE ANIMAL TECHNICIAN
CERTIFICATION BOARD OF THE ANIMAL CARE PANEL

A. Persons employed as “junior laboratory animal technicians,” or equivalent, should have at least 1 year of apprentice training or experience in laboratory animal care and should have acquired elementary knowledge of subjects, such as:

(a) Routines of feeding and watering laboratory animals.
(b) Method of cleaning animal cages and equipment.
(c) Basic principles of sanitation and disinfection.
(d) Recognition of vermin and their control.
(e) Personal hygiene.
(f) Restraint and handling of laboratory animals.
(g) General and personal safety in animal facilities.
(h) Recordkeeping and animal identification methods.
(i) Basic principles of biology (i.e., structure and function of organ systems).
(j) Sexing of animals; gestation periods; weaning ages of the common laboratory species.
(k) The signs of normal health and behavior in laboratory animals.
(l) Principles of the experimental method.
(m) The meaning of responsibility for the care and management of a group of experimental animals.

B. Persons employed as “senior laboratory animal technicians,” or equivalent, should have at least 3 years experience in laboratory animal care. They should have a more extensive knowledge of all of the subjects listed for junior laboratory animal technician. In addition they should have training or experience in the following subject areas:

(a) Recognition of clinical signs of illness in laboratory animals.
(b) Animal nutrition, including the preparation of special diets.
(c) Elementary genetics, including the breeding of laboratory animals.
(d) Supervision of animal care personnel, including the planning of work routines.
(e) Administrative procedures and recordkeeping.
(f) Laboratory and technical procedures such as preparation of surgical equipment, euthanasia, oral and parenteral administration of drugs under supervision, bleeding of animals, assistance with preoperative and postoperative care of animals.

C. Persons employed as “supervisors,” or equivalent, should have at least 8 years of experience in laboratory animal care, at increasing levels of responsibility, or an equivalent combination of education and experience. They should be able to carry on the day-to-day management of laboratory animal care, under the policies established for their units, and under the general supervision of the director. Their knowledge and experience in animal care should enable them to instruct apprentices personnel and junior and senior laboratory animal tech-
nicians, both on the job and in the classroom. In addition, supervisors should have specific training or experience in the following areas, including those that are necessary for the proper performance of their duties:

(a) Administration of animal facilities including purchasing, detailed recordkeeping, cost accounting, and management of animal-care personnel.

(b) Supervision or operation of a surgical laboratory including preparation of complex equipment, service as a surgical assistant, implementation of a prescribed program of postoperative care.

(c) Operation of laboratory facilities including performance of routine clinical laboratory procedures in bacteriology, hematology, and parasitology.
In addition, supervisors should be aware of the following areas, including those that are part of their duties:

- Laboratory including preparation and implementation of surgical assistant, implementation of routine care.
- Laboratory including performance of routine bacteriology, hematology, and parasitology.

### Appendix III

**SELECTED BIBLIOGRAPHY ON THE CARE AND MANAGEMENT OF LABORATORY ANIMALS**

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