CHAPTER **34**

Animal housing

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Key Points

- All species of companion animal are likely to require some form of housing at some time in their lives. Whatever the species, design of the accommodation must mimic as closely as possible the animal's natural habitat.
- The design of kennels and catteries must take into account construction materials, ventilation, lighting, heating and bedding.
- Prevention of the spread of disease is of paramount importance within any animal accommodation facility and this is mainly brought about by meticulous cleaning and attention to detail.
- Disinfection plays a vital role in controlling the spread of disease but the choice of disinfectant depends on such factors as the active ingredient, the causative organism, the area in which it is used and the safety of the patient and personnel using it.
- Waste materials generated by a veterinary practice must be disposed of according to the regulations laid down in the Environmental Protection Act 1990 and the Special Waste Regulations 1996.

Introduction

Despite the fact that in this country most dogs and cats are given the freedom of their owner's house and garden there will be times when some form of cage or kennel is required. The smaller and more exotic species of companion animal, e.g. rabbits, mice, snakes or birds, are usually kept caged all the time and details of their accommodation is included in Chapter 31.

There are many different types of animal care business that may provide accommodation for animals, but whatever the situation, the kennelling or caging must be suited to the individual animal and the circumstances in which it is being housed. Some examples of the housing in which dogs might be kept include:

- Privately owned kennels (requiring no licence)
- Privately owned licensed breeding kennels (e.g. more than two breeding bitches)
- Boarding (kennels/cattery/exotics)
- Whelping/puppy
- Quarantine
- Racing
- Training (police, army, customs, security, guide/hearing dogs and dogs for the disabled)
- Rescue, e.g. animal shelters, Royal Society for the Prevention of Cruelty to Animals (RSPCA)
- Veterinary practice.

Within a veterinary practice you will see many different patients that require individual attention and accommodation. These can be categorized as:

- Day patients – patients awaiting minor treatment and/or routine surgery that can go home the same day. Large, medium and small kennelling is available depending on the size and treatment of the patient (Figs 34.1 and 34.2). Ideally there should be a method of securing the patient's hospital notes/consent form onto the kennel so that easy identification of the patient can take place and nursing care identified (Figs 34.1 and 34.2). A stainless steel board is often used as the patient cannot chew it and it can be cleaned effectively. A hand disinfectant can be clipped to the kennel to ensure that the nurse's hands are cleaned between patients. However, the nurse must ensure that the patient does not have access to this
- Overnight hospitalization – these patients will require constant monitoring and may require medication or treatment throughout the night. Personnel must be on hand to do this. Medication and emergency equipment should be close at hand. Figure 34.3 shows a large kennel containing a heat source, electrical points situated away from the patient with a light and an adjustable chain from which to hang a fluid bag
- Recovery from theatre – these kennels will be situated so that constant monitoring can be maintained
- Isolation – these are separate from the main kennelling area with their own supply of bedding, feeding and watering equipment, medication and a nurse to maintain barrier nursing. Kennels may be enclosed with their ventilation and, if necessary, can convert to an oxygen tent
- Noisy and aggressive patients may be housed away from the main kennels to avoid distressing other patients. However, these patients still require constant monitoring

Fig. 34.1 A walk-in kennel suitable for large dogs

Fig. 34.2 A small kennel suitable for cats, small dogs and rabbits

- Intensive care unit – as with postoperative kennelling this will have constant monitoring, preferably with its own nursing team. Kennels may be enclosed with their own ventilation and, if necessary, can be converted to an oxygen tent. For smaller patients, neonates and exotics the use of an incubator is very useful. The temperature required can be set and the humidity changed depending on the species and treatment required (Fig. 34.4).

Within a practice there are usually two or three different sizes of kennel, which are then appropriately adapted to meet the requirements of the individual. As the patient does not spend very long in the kennel its specific needs are less important providing it is secure, warm and correctly fed and watered.

Construction of animal housing

Consider the following aspects.

Siting

Whether the housing for the animal is indoors or outdoors there are many points to take into consideration:

- Site the housing away from wind and rain. If indoors avoid draughts from doors and windows
- Ensure that the accommodation receives adequate lighting. Consider the use of natural light, avoiding sun scorch, and provide shade if necessary

Fig. 34.3 Heat source, light and electrical points should be situated out of reach of the patient

- Consider whether the site should be close to other animals. Avoid housing a prey species close to a predator, e.g. do not put a cat near to a mouse or a bird
- Site the accommodation to blend in with its environment. Avoid 'eyesores', especially if neighbours might be offended

- Use natural topography to enhance the look of the housing, e.g. trees, shrubs and natural construction materials
- Site the accommodation on level, secure, stable ground
- Consider whether soundproofing is required. This can be done internally by insulating the main building with acoustic tiles, double glazing and double doors and also externally by earth banks and walls built around the housing. Tree belts can also insulate the sound
- If building commercial accommodation, consider whether there are adequate amenities such as water, electricity, sewerage (mains or tank) and road access
- Ensure that all licensing, building and planning regulations are met
- Building regulations will require adequate damp-proofing, insulation, ventilation and fire regulations. Fire regulations include a fireproof covering on walls and ceilings, fire doors and covering any wooden framework with a fire retardant.

Fig. 34.4 An incubator can be used as an intensive care unit for smaller patients and neonates

Security

Security must be a priority for the animal, its owner and staff members. The animal must feel safe from predators and personnel must feel confident that the animal cannot escape. Ensure that the individual cages or kennels are secure with locking doors and that the enclosing building has some means of retaining the animal should it escape, e.g. double doors, windows covered in mesh.

Care facilities

Site the accommodation close to service areas, such as food stores and preparation areas. A room for washing and feeding equipment and bedding should be nearby, as well as facilities to store and dry bedding. For dogs a grooming and bathing area is advisable. In a hospital the accommodation must be close to treatment rooms and operating theatres. The layout of the entire building must be efficient to use; for example, try to reduce long journeys between rooms that are regularly used together.

Construction materials

The materials used depend upon the species or the animal's individual requirements (Table 34.1). The design of cage or enclosure will also influence the choice of construction

Table 34.1 Common materials used in the construction of animal housing

Material	Uses	Comments
Cavity brickwork (brick or breeze blocks)	External and structural walls	Secure and insulating. Pervious but can be painted with waterproof paint
Sealed concrete	Floors, walkways and pathways	Impervious, therefore easy to clean. Drainage can be included by the use of pipes or a fall to guttering. Rodent-proof and escape-proof
Galvanized metal	Ready-made partitions, walls, doors and windows	Strong, secure but expensive. Heavy
Aluminium sheeting	Walls, partitions and doors	Easy to clean, smooth and reasonably inexpensive
Stainless steel	Walls, partitions and doors	Easy to clean, smooth. May be expensive
Toughened plastic/fibreglass	Walls, partitions and doors	Easy to clean, smooth and inexpensive. May be chewed and scratched
Glass	Walls, partitions, windows and doors	Easy to clean, smooth and inexpensive. Transparent, allowing light to enter and the animal to see out. Can be double-glazed to increase insulating properties
Laminated plastic	Walls and partitions	Transparent, allowing light to enter and the animal to see out. Can be chewed and scratched
Wood	Walls, partitions and framework	Inexpensive but rots and can be chewed by the animal. Not escape-proof. Not easy to disinfect and can harbour infection. Risk of splinters and a fire hazard
Wire mesh	Partitions	Often used with a wooden framework. Must use an appropriate-size mesh for the animal, e.g. dogs require less than 2.5 cm^2 to avoid the risk of trapping paws
Asphalt and vinyl flooring	Floors and moulded into walls	Used to cover concrete flooring to waterproof and give non-slip flooring
Tiles	Walls and floors	Washable and waterproof (ensure tile grout is waterproof)

Table 34.2 Examples of different types of animal housing

Type of housing	Species of animal	Comments
Run-access kennel	Dog and cat	Can buy ready-made sections and erect yourself. There is an internal sleeping section and external run for exercise. Commonly used by private owners. Cannot control heating and ventilation easily. Not easy to control aggressive or lively dogs. Observation is difficult if animal is inside
Corridor kennels	Dog and cat	Allows many kennels to be built side by side within one building. Internal kennels are located down each side of the building with a walkway down the middle. Runs on the outside of the building are connected to the inside by a hatch, which can be opened by a pulley system to avoid the need for entry into the kennel
Parasol kennels	Dog and cat	Similar to the corridor kennels but built in a circular building instead of a rectangular one. More expensive to build but the main advantage is that all the animals can be observed from one position
H-block kennels	Dog and cat	This is used only when housing a large number of animals. Four kennel blocks are arranged together to form an 'H', the cross bar of the 'H' being a preparation area
Single room kennel	Dog, cat and rabbit	Commonly used in a hospital environment where the patient does not require a run as it is a short-term stay. Modern kennelling is made from stainless steel as it is easy to maintain and disinfect. Steel bars or toughened glass at the front of the cage allow easy observation. Various sizes are available to include walk-in and stackable kennels
Hutch/morant cage	Rabbits, guinea pigs and ferrets	Usually wire mesh with a wooden framework. Can be outside all year or moved inside in cold weather
Metal cage with bars	Small rodents	Often has a plastic bottom for comfort for the animal and ease of cleaning
Rotastak cage/gerbilarium	Small rodents, especially mice and hamsters	Made out of plastic with metal bars. Multilevel
Aquarium	Fish, some reptiles and amphibians	Made out of toughened glass or plastic with a lid on top. Accessories include substrate, water, lighting and filter
Vivarium/terrarium	Reptiles, amphibians, arthropods and molluscs	Made out of toughened glass or plastic with a lid on top. Accessories include heating, lighting and shaded area
Aviary	Birds	Can be internal cages or external areas for many birds. Outside aviaries have a covered/internal area for shelter

materials and examples of the different types are shown in Table 34.2. The ideal materials should have the following properties:

- Cost-effective – balance the cost against the quality
- Hygienic and easily cleaned (Fig. 34.5)
- Good quality – last a long time while maintaining effectiveness and looks
- Safe for both the animal and the handler
- Easily maintained – requiring few/no repairs to maintain function
- Eco-friendly – use recycled materials or materials from a reputable source
- Warm and insulating to maintain temperatures required by the animal
- Easy to construct
- Easily available.

Kennel services

Ventilation

Ventilation is one of the most important factors when designing any form of animal housing. It is important to avoid draughts at ground level, which will chill animals, but a through flow of air must be maintained to prevent a build-up of bacteria and reduce the transmission of airborne infection. Good ventilation will remove exhaled gases and fumes from excreta, ammonia and methane, leaving the air clean and odourless. The optimum air changes per hour are 6–12, depending on the number of patients and the weather conditions.

There are two types of ventilation:

- **Passive ventilation** – achieved by opening and closing windows, doors and vents. The disadvantages of passive ventilation are that it is difficult to control the flow of air and it may cause draughts. It also may offer an escape route to patients
- **Active ventilation** – or mechanical ventilation, which is usually achieved by either an extractor fan and vents or an air-conditioning system:
  - **Extractor fan and vents** – vents are placed into the walls of the building and an extractor fan is placed in the centre of the roof or ceiling. As the extractor fan works it pulls air up and out of the building. This air is then replaced by air drawn in through the side vents, maintaining the cycle of clean air

Fig. 34.5 A large kennel being hose-cleaned

- **Air-conditioning system** – clean air is actively 'pushed' into the building by the air-conditioning unit and another unit pulls out the stale air, thus maintaining a cycle of clean air. In hot weather the unit cools the air and in cold weather it heats it, maintaining a constant set temperature. This is the more expensive of the two active systems.

Lighting and electrical equipment

There are several reasons why it is essential to provide lighting within the accommodation, whether it is natural, i.e. sunlight, or artificial:

- Procedures such as treatments and medications can be carried out safely and effectively. Poor lighting will cast shadows, which will make daily activities difficult
- Observation of the animal is easier with good lighting; it avoids the need to disturb the animal in order to be able to see it properly
- An animal that has adequate lighting in its house will be able to gain optimum mental stimulation from its environment
- Remember that it is necessary to reduce the animal's lighting to allow for resting and sleeping periods. The animal's sleeping area should not have direct light entering into it.

Natural lighting in normal periods of day and night, i.e. the photoperiod, is recommended to allow the animal to express its normal behaviour. However, care should be taken that sunlight does not cause overheating in warmer weather. In short winter days and where natural lighting is sparse, supplement with artificial lighting, such as fluorescent strip lights with a diffuser. This provides good coverage of light to most areas, without shadows. Individual bulkhead lights can be positioned in the kennels for extra light. Never use hanging light bulbs, as the animal could reach and chew them. They also hang in the way when cleaning out the accommodation, posing a risk of electrocution. Switches to the lights should be placed outside the accommodation and covered with a waterproof safety cover. All cabling inside and outside requires a waterproof covering. Circuit breakers should be used on all electrical equipment to 'trip' out the power should it be damaged in any way. All plugs should have the appropriate-sized fuse inside them.

Table 34.3 Environmental temperatures for dogs and cats

Type of animal	Environmental temperature
Adult dogs	Run area 7–26°C Sleeping area should not fall below 10°C
Adult cats	Whole area should not fall below 10°C
Whelping area	18–21°C
Puppies	Week 1: 26–29°C Week 2: 21–26°C Week 3 up to weaning: 20°C
Hospital and isolation areas	18–21°C

Heating

Providing the correct temperature appropriate for the species and condition of the animal is paramount to its well-being. Temperature and humidity should replicate its natural environment as much as possible. A range of temperatures for individual species can be found in Table 34.3. Heating is essential:

- To provide the correct environment for the animal
- For maintenance of buildings and equipment; heating will prevent water pipes freezing, and subsequently bursting, as well as controlling condensation within the building
- Some equipment, especially electrical items, will not work in cold, damp environments
- A warm environment helps to dry accommodation and other areas after cleaning, e.g. after floors have been mopped
- Staff will appreciate working in a warm environment.

Care should be taken when assessing the temperature within a building and/or within individual accommodation. Rarely will the temperature be the same throughout the area. Remember that warm air rises and there may be several degrees difference between a floor kennel and one placed higher up. Changes in temperature occur from day to night and it is important to consider this, especially with overnight patients in hospital. There is a risk of temperature variations if a timer switch controls heating.

Temperature changes will occur with draughts from doors and windows and it is advisable to have double doors to avoid this. Cavity wall and roof insulation will prevent excess heat escaping from main buildings.

Types of heating

The ideal method of heating should be easy to install, simple and economical to run and safe for the operator and the animal. There are two types of heating available:

- Central heating heats the entire building and the animal accommodation within it; it is controlled by a thermostat that regulates and keeps the temperature set
- Local heating is provided to an individual animal or area.

The advantage of using both types is that the environmental temperature remains constant and those animals requiring extra heat, e.g. exotics or sick animals, can be housed in the same area. Table 34.4 shows the advantages and disadvantages of both types.

Bedding

There is a wide range of pet bedding available (Table 34.5). The choice depends on the species of animal, the size and weight and the reason for providing bedding, i.e. Is it healthy, recumbent, aged or orthopaedic?

Bedding is used to provide:

- Comfort and warmth to the animal by insulating it
- Somewhere to sleep
- A soft place to rest that will prevent the animal developing decubitus ulcers (bed sores) from lying on bony prominences
- A postoperative place to recover that will prevent the animal injuring itself as moves around.

The properties of the ideal bedding material are as follows:

- Insulating to make the most of the animal's own body heat
- Soft and comfortable
- Large enough for the size of the animal when fully stretched out
- Good absorbency and drainage to wick away any body fluids
- Non-toxic to the animal
- Easily cleaned, disinfected and dried or disposed of and recycled
- Easy to store
- Cheap.

Table 34.4 Advantages and disadvantages of different types of heating

	Advantages	Disadvantages
Central heating		
Gas, oil and electric boilers	Common, often already installed in existing buildings. Easy to operate and maintain	Often warm and cold spots in the room depending on the placement of the radiators. Open pipes are difficult to clean and will harbour dirt
Gas, oil and electric underfloor heating	Heat in close contact with the animal and therefore warm and comforting	Expensive to install and costly to repair
Fan-assisted heating	Rapid heating in the area. Inexpensive	Often warm and cold spots in the room depending on the placement of the fan. Noisy to operate
Air-conditioning units	Highly effective at maintaining a constant temperature. Often incorporated into the ventilation system. Can blow hot and cold air. Easy to operate	Expensive to install and run. Suitable for large establishments
Local heating		
Infrared dull emitter lamp	Mobile, soothing and able to be regulated by adjusting the height of the lamp. Can be thermostatically controlled	Requires a power point nearby. Risk of fire and injury to the animal if able to reach it
Electrical heat pad	Direct contact with the animal. Constant heat	Animal may chew it, resulting in electrocution
Portable radiant heater	Portable instant heat	Can be knocked over and cable chewed. Requires constant monitoring
Electric fan heater	Instant heat	Risk of hyperthermia if the animal is unable to move away from the heat. Noisy
Hot water bottle	Cheap and instant heat	Animal may chew or it may burst. Will cool down so requires monitoring
Chemical heat pads	Instant heat	Animal may chew or it may burst. Will cool down so requires monitoring
'Hot hands' water-filled plastic gloves	Cheap and instant heat. Good for small animals	Animal may chew or it may burst. Will cool down so requires monitoring

Table 34.5 Common types of bedding

Type of bedding	Disposable/ reusable	Advantages	Disadvantages
Acrylic bedding, e.g. Vetbed	Reusable	Absorbable, warm, soft, durable, washable and some can be autoclaved	Reasonably expensive. Can be chewed
Blankets and towels	Reusable	Warm, soft and washable. May be donated by owners	Can harbour mites if not washed at high temperature. Expensive to buy
Covered foam pads/foam chips or wedges	Reusable	Washable cover and foam. Provides support and warmth, especially to orthopaedic/recumbent cases	Can be chewed. Large foam pads can be difficult to wash
Newspaper	Disposable and recyclable	Cheap and readily available. Often used underneath a blanket to absorb fluid. Provides some warmth	Hard to lie on and the animal may chew it. The printing ink will stain the animal, especially if it becomes wet
Incontinence sheets	Disposable	Often used on top or underneath a blanket to absorb fluid. Useful for incontinent patients. Provides some warmth	Hard to lie on and the animal may chew it. Expensive for disposable bedding
Shredded paper	Disposable and recyclable	Provides more warmth as bulkier than unshredded paper. Animals can burrow into it and arrange it as they would like	Can be eaten. Paper may stick to wounds and require soaking off
Bean bags	Reusable	Can be arranged by the animal. Moulds to body shape. Insulating and warm	Only the washable cover can be cleaned. Bean bag may harbour infection. Chewable
Straw/hay	Disposable and recyclable	Warm and absorbable. Reasonably cheap	Dusty, prickly and may harbour mites, lice and bacteria. May be a source of *Aspergillus* spores, which can cause respiratory disease. Do not use if the patient has a wound, as it will stick
Woodchips and woodwool	Disposable and recyclable	Warm and absorbable. Reasonably cheap	Can cause allergic reactions. Do not use if the patient has a wound, as it will stick to it
Sawdust	Disposable and recyclable	Warm and absorbable. Reasonably cheap. Good for some rodents and exotics. Allows for burrowing	Dusty and may harbour mites, lice and bacteria. Do not use if the patient has a wound, as it will stick to it
Pre-sterilized peat	Disposable and recyclable	Warm and absorbable. Good for some rodents and exotics. Reduces the ammonia emitted in excreta and therefore reduces smell	Expensive. Do not use if the patient has a wound, as it will stick to it

Specific kennel requirements

As shown in Table 34.2 there are a wide variety of kennels available to house dogs, whether it is a single kennel to house a dog in your own home or a commercial establishment. Dogs can be kept inside or outside as long as the accommodation suits the environmental conditions. Temperature details are shown in Table 34.3 and depend upon the condition of the animal and the reason for kennelling. Whatever the specific details, each kennel requires the following:

- A sleeping and exercising area (Table 34.6)
- A toilet area or a regular opportunity to go to the toilet
- Heating to the required temperature in the sleeping area
- Lighting
- A raised bed, preferably removable to clean, and appropriate bedding material
- A water bowl full of clean water at all times – automatic drinkers are available
- Ventilation, either in the kennel or main building
- Feeding equipment
- Mental stimulation, e.g. toys to play with.

Table 34.6 Guidelines for individual kennel sizes as recommended by the Chartered Institute of Environmental Health

Size of dog	Height of kennel (m)	Exercise area (m^2)	Sleeping area (m^2)
Up to 60 cm at shoulder	1.85	2.46	1.9
Over 60 cm at shoulder	1.85	3.35	1.9

Specific cattery requirements

As shown in Table 34.2 there is a variety of cat housing available that allows the cat to be kept inside or outside as long as the accommodation suits the environmental conditions. Temperature details are shown in Table 34.3 and will depend upon the condition and reasons for housing. Cat housing differs from the dog housing in that cats are able, and should be encouraged, to climb. There is also a greater risk of respiratory infection when cats are housed in close proximity to

each other and allowance must therefore be made for this. A 'sneeze barrier' of 0.6–1.2 m must be left between each open run and the next and all the accommodation, both sleeping and exercising areas, must be covered. In indoor catteries it is vital that good ventilation is installed to remove stale air and prevent cross-contamination. Transparent panelling can be used instead of wire mesh to prevent cross-contamination of air. Each individual cattery unit (Table 34.7) requires the following:

- A sleeping and exercising area
- A toilet area, preferably with a litter tray
- Heating to the required temperature
- Lighting and ventilation

Table 34.7 Guidelines for individual kennel sizes as recommended by the Model Licence Conditions and Guidance for Cat Boarding Establishments

Number of cats	Height of unit (m)	Exercise area (m^2)	Sleeping area (m^2)
1	1.8	1.7	0.85
2	1.8	2.23	1.5
Up to 4	1.8	2.79	1.85

The raised bed for sleeping must be at least 91 cm above floor level and no more than 106 cm deep.

- A raised bed, preferably removable, lined with appropriate bedding material
- A water bowl filled with clean water at all times – automatic drinkers are available
- Scratching post and toys to play with
- An escape-proof window and sill that the cat can climb up to and look out of. (This is recommended by the Model Licence Conditions and Guidance for Cat Boarding Establishments.)

Methods of disease control

In the environment of a kennel, cattery or a veterinary practice it is essential that procedures are instigated to control the spread of pathogens, so reducing the risk of a disease outbreak. This must be done on a daily basis and involve both sick and healthy animals. Disease can spread easily but an understanding of the factors that increase the risk of infection will help to prevent its spread (Table 34.8).

Cleaning and disinfection of accommodation and the environment

It is important to understand the terminology associated with cleaning and disinfection and the following list defines the important terms that apply to cleaning the clinical environment:

Table 34.8 Factors affecting the spread of disease

Method of disease control	Reasons	Prevention
Avoiding direct contact between animals	Where there are a lot of animals housed in the same environment the pathogenic population will increase. Allowing animals to mix with each other freely increases the risk of disease transmission	Do not allow animals to have contact with each other. Sick and/or infectious animals should not be housed with healthy ones
Reduce the number of animals sharing the same air space	Dust, spores, bacteria, viruses, humidity and noxious gases build up in the environment around the animal. If there are several animals sharing the same air space then this will increase the risk of disease being spread to the others by indirect contact	Good ventilation is vital to ensure that the air is constantly fresh and carries pathogens out of the accommodation. Good ventilation will reduce the risk of draughts and provide an appropriate atmosphere and constant temperature
Maintaining good hygiene	Accommodation that has a build-up of faeces and urine not only makes the animal uncomfortable but also increases the risk of infection building up by harbouring bacteria, spores and viruses	Regular cleaning and disinfection will reduce the risk of infection as well as improving the well-being of the animal
Early diagnosis and effective treatment of sick animals	If the animal becomes unwell it is vital that this is noticed as soon as possible to reduce the risk of the illness being transferred to other animals	Observing for signs of ill health should be carried out regularly through daily health checks that include the animal's appearance, faeces, appetite and temperature. Infected animals should be isolated immediately
Avoiding animals sharing the same kennel, feeding, watering and grooming equipment	This increases the risk of infection being transferred by direct contact	Ideally the animal should have the same housing every day, as well as its own feeding and grooming equipment. Should the need arrive to move the animal and/or use other equipment, then this should be thoroughly cleaned and disinfected
Routine health checks	Animals new to the housing may be harbouring a disease and not yet showing any clinical signs. They should be isolated and given a full health check	Preventative medicine is the use of veterinary treatment and environmental conditions to reduce and control the build-up of disease. This includes environmental conditions as well as the use of vaccinations, worming programmes, health certificates, quarantine and passports

- **Disease** – a process that detrimentally interferes with the functioning of an organism. Diseases may be infectious or non-infectious
- **Microorganism** – a living organism too small to be seen with the naked eye
- **Pathogen** – a microorganism capable of causing disease
- **Antiseptic** – a chemical that will inhibit/destroy pathogens without damaging animal cells. Used on the skin and for cleaning wounds
- **Disinfectant** – a chemical that will inhibit/destroy pathogens but not bacterial spores. As disinfectants may damage skin cells, they are used mainly in the environment, e.g. floors, kennel walls
- **Sterilization** – A method of killing microorganisms such as bacteria, viruses, fungi, protozoa and prions, including bacterial spores. There are various methods of sterilization:
  - Cold chemical solutions – also known as sterilants
  - Ethylene oxide gas
  - Radiation
  - Heat – either under pressure, e.g. autoclave, or dry heat, e.g. hot air oven
- **Detergent** – a cleaning agent
- **Surfactant** – a chemical that reduces/breaks surface tension, allowing the detergent to reach the pathogen. Detergents normally contain a surfactant
- **-cide** – used as a suffix to indicates that the chemical will kill a particular type of organism, e.g. a bactericide will kill bacteria and a tuberculocide will kill *Mycobacterium tuberculosis*
- **-stat** – used as a suffix to indicate that the chemical will inhibit the growth of a particular type of organism, e.g. fungistat or coccidiostat.

The importance of cleaning

One of the most important factors of managing animal accommodation is to provide a clean and hygienic environment in which the patients live and the staff work. This is achieved by regular cleaning and disinfection of both the accommodation and equipment.

The reasons for this are:

- Organic matter such as urine, faeces and hair can harbour endoparasites, ectoparasites, bacteria and viruses, which can multiply and infect other patients
- Regular cleaning removes pathogens and therefore reduces the risk of infecting the patient
- The animals are more comfortable living in a clean and dry environment and are less likely to become cold, dirty and susceptible to disease
- The environment looks and smells nice, which will benefit the patients and staff and create a good impression for clients.

The key areas to clean and disinfect are:

- Animal cages or kennels
- Surrounding areas, e.g. corridors, room in which cage is kept
- Preparation areas
- Examination rooms
- Treatment rooms
- Personal hygiene.

The principles of cleaning

Cleaning and disinfection is achieved by both physical activity and the use of chemicals. There are general guidelines which apply to the cleaning and disinfection of any type of equipment or accommodation. These are:

- All equipment must be washed and disinfected daily – more often if the patient is infectious
- Wherever possible the animal should be removed from the accommodation to avoid the risk of inhaling the cleaning fluids and of injury caused by cleaning equipment. It is also easier to clean an empty kennel and avoids the problem of the animal escaping!
- Always wash equipment with a detergent before using a disinfectant to remove organic material. Ensure that the detergent is thoroughly rinsed off before disinfection as this may inhibit the action of the disinfectant
- All work surfaces, floors and equipment must be cleaned and disinfected
- The use of disposable gloves and an apron is advised for both safety and hygiene
- A high standard of personal hygiene is essential. Wash hands before and after handling any animal
- Prepare the animal's food in a room which is separate from where the cleaning equipment and waste is stored
- Always use a disinfectant that is recommended for the type of material to be cleaned
- Always follow the manufacturer's instructions when using any cleaning products.

Cleaning equipment

All cleaning equipment and disinfectants should be stored in a separate area. After each use all equipment should be cleaned, disinfected, rinsed and dried. There are various pieces of equipment that can be used for cleaning and disinfecting. These are:

- Mop and bucket – ideally this should be a double bucket to hold the disinfectant and water in one side and clean water in the other to rinse off the mop
- Hand brushes to scrub surfaces. Plastic brushes are easier to disinfect after use than ones with wooden handles
- A vacuum cleaner to clear floors of any dust and hair prior to cleaning. The advantage over using a floor brush is that dust is not spread around. Waste from the vacuum cleaner should be disposed of as clinical waste
- A floor brush/dustpan for cleaning up dust and hair prior to cleaning
- Cloths for cleaning surfaces and equipment should be used once and then thrown away. If this is uneconomical, then they should be washed and disinfected after use and dried.

Cleaning a kennel unit

The procedure for cleaning and disinfecting a kennel unit is summarized in Table 34.9. This procedure can be adapted to suit the individual animal.

When selecting a chemical for cleaning (Box 34.1) it is important to consider the following points:

Table 34.9 Procedure for cleaning and disinfecting a kennel

Step	Procedure	Equipment
1	Move animal into run/secure holding area. Ensure that no other animal has used it. This must be cleaned after use	Slip lead or collar and lead. Cat box
2	Remove bedding, toys and feeding equipment. Disposable bedding should be put in clinical waste; other bedding is washed (in an appropriate disinfectant) and dried. Other equipment requires cleaning and disinfecting before replacement	Disposable gloves
3	Remove soiling (faeces, urine, vomit, saliva and other body discharges)	Disposable gloves. Shovel, scraper
4	Hose out hair/debris. A vacuum cleaner or dustpan and brush can also be used before hosing	Pressure hose and/or steam cleaner. Vacuum cleaner or dustpan and brush
5	Scrub with warm water and detergent. Some detergents contain a disinfectant; therefore only one product is used to clean and disinfect	Scrubbing brush or cloth. Spray bottle or bucket
6	Rinse with water	Hose or bucket
7	Apply disinfectant of an appropriate type for the walls, floor and equipment being cleaned and the suspected pathogen being targeted	Disposable gloves, cloth, brush or spray bottle
8	Allow appropriate contact time for disinfectant to work	
9	Rinse thoroughly with water	Hose or bucket
10	Dry	Squeegee or cloth
11	Leave to air-dry for as long as possible	
12	Replace bedding	
13	Return animal, checking that the patient is clean	

Box 34.1 The ideal disinfectant

The ideal disinfectant should have the following properties:

- Will destroy the intended microorganisms
- Will decontaminate organic matter
- Effective in clean and dirty situations
- Works quickly, i.e. contact time is short for the disinfectant to be effective
- Effective in both hot and cold water
- Non-toxic and safe for the operator, other people in the environment and the patients
- Non-corrosive to surfaces
- Does not stain surfaces
- Pleasant to work with, i.e. no noxious gases
- Economical
- Stable, e.g. non-explosive when stored
- Will not denature if stored for a long time.

- The intended surface to be cleaned, i.e. Is it for use on a patient or for the environment?
- What microorganism is to be targeted? Ensure that the product chosen will be effective against the intended microorganism. Broad-spectrum disinfectants that act on a range of microorganisms are available for general cleaning
- Will the product damage the surface for which it is intended? When disinfecting rubber and plastic, care should be taken, as some disinfectants will corrode the material. Always follow the manufacturer's recommended contact time
- Safety for the user and other staff and patients: Is the product non-toxic and non-irritant?

Susceptibility of microbes to disinfectants and sterilization

There are various methods of testing the efficacy of a disinfectant against different organisms and materials. The Rideal–Walker test compares the action of phenol-based products on microorganisms while the Chick–Martin test compares the action of phenols on organic matter. The most useful test is the Kelsey–Sykes test, which tests the action of most types of disinfectants on both microorganisms and organic matter.

Bacteria can be divided into either 'Gram-positive' or 'Gram-negative' groups depending on the structure of the cell wall and its reaction to the Gram stain. Knowing which group the bacteria fall into can assist in the choice of disinfectant. Gram-positive bacteria are more sensitive and, therefore, more easily destroyed, while Gram-negative bacteria are quite resistant. Bacterial spores are the most resistant and specific disinfectants are required to destroy them. Some prions, i.e. abnormal forms of a cell protein that are capable of replication and causing infection, can resist sterilization by normal methods and therefore require longer sterilization times, preferably by autoclave.

Factors affecting the efficacy of disinfectants

As with all chemical products it is important to read the manufacturer's instructions to get the optimum effectiveness and efficiency from the disinfectant used. However, as a

guide the following may help improve the effectiveness of the product:

- Reduce the level of contamination by organic matter by cleaning the area prior to disinfection. This allows the disinfectant to reach its target without reducing its concentration
- Warm water may increase the disinfectant's effectiveness on the microorganism. Refer to the instructions for the optimum temperature of the water
- Always use the recommended concentration of water to disinfectant. Using too high a concentration may be harmful to the operator, patient and/or environment. Too low a concentration of disinfectant may be ineffective
- Use a large volume of disinfectant solution to reduce the level of contamination
- The pH of the water may alter the effectiveness of the disinfectant
- Disinfectants may become denatured if left in storage for too long. If the product is made up into a solution it should be used as soon as possible
- Some disinfectants are inactivated by the presence of soap, organic matter and cork/rubber surfaces.

Disinfectant groups

There are many different groups of disinfectants available and many have a detergent built in to them. Most modern disinfectants can be used on a variety of materials without harm, but it is vital to read the instructions and performance data to ensure correct storage, dilution and use.

The main groups of disinfectant are:

- Alcohols
- Aldehydes
- Biguanides
- Halogens
- Peroxides
- Phenols
- Quaternary ammonium compounds (QACs).

Alcohols

- Used for skin disinfection and cold sterilization
- Effective on bacteria but not spores or viruses
- Alcohol works by coagulating bacterial cell proteins, so that they cannot function
- Examples are ethyl alcohol, isopropyl alcohol, IMS (methylated spirit), surgical spirit
- Alcohol is an organic compound, i.e. it is carbon-based
- Absolute alcohol has all water removed; however, in practice, alcohol is usually used as a 70% solution
- Alcohol is volatile: it evaporates and, therefore, if it is left in an open container it will loses its effectiveness quickly
- Once introduced, contamination will quickly spread through the alcohol and if used on a site will spread even further
- Commonly used as a swab for injection sites as it removes lipids from the skin surface. If it is used repeatedly, it will be necessary to apply a skin lotion, as the site will become sore.

Aldehydes

Aldehydes are divided into two groups: formaldehydes and gluteraldehydes.

Formaldehydes

- Used in environment only
- Uses include solution for histopathological specimens and sterilization for vaccines. Kills microorganisms without altering their antigenic properties, thus stimulating antibody production without causing disease
- Effective on spores but, because it is highly irritant to many things, its use as a disinfectant is limited
- Works by 'fixing' cell proteins, rendering them useless
- Examples are Parvocide and Formula H
- Formalin is 37% formaldehyde gas in water but for the sake of calculations it is used as 100%
- Histopathological specimens are stored in a 10% buffered formalin solution and for a 1 cm × 1 cm × 1 cm specimen at least 10 mL of solution must be used
- Like alcohol, formaldehyde easily evaporates.

Gluteraldehydes

- Used in the environment only
- Used for cold sterilization, i.e. for instruments/equipment that cannot be autoclaved
- It is effective on bacteria, viruses and, if left long enough, spores
- Work by protein inactivation
- An example is Cidex
- Gluteraldehydes are more modern than formaldehydes and are less of an irritant to tissue.

Biguanides

The form of biguanide that we use in practice is chlorhexidine:

- Used for skin cleaning and scrubbing up surgical sites
- Effective on Gram-positive bacteria and fungi, not spores or viruses
- Examples of chlorhexidine are Hibiscrub and Hibitane
- Biguanides have a low toxicity but are easily inactivated by organic matter and soap – when scrubbing up, ensure that the area is free from both
- Cotton wool left to soak in a solution of chlorhexidine and water will become inactive as the day progresses – always use a fresh solution on each patient.

Halogens

Halogens are oxidizing agents that react with protein molecules in the cell, resulting in the exchange of oxygen and inactivation of the cell processes.

Halogens are divided into:

- Iodine (inorganic)
- Iodophor (organic)
- Chlorine
- Fluorine and bromine.

Iodines

- Used as a skin cleaner and surgical preparation
- Effective on bacteria, fungi, protozoa and some viruses but not bacterial spores
- Examples of iodines are Povidone and Betadine
- Inorganic and difficult to dissolve in water, so is dissolved in sodium or potassium as iodide. This is used as a 2% solution for topical use. It can also be used dissolved in alcohol as a tincture
- Stains the surface brown and may also be a tissue irritant if too big an area is covered

Iodophors

- Used as a skin and surgical preparation
- If formulated with a detergent, can also be used on equipment, walls and floors
- Iodophors are effective on bacteria, fungi, protozoa and some viruses but not bacterial spores
- An example is Wescodyne
- Iodophors are iodine bound to organic molecules. These act as carriers and as such are less toxic than iodine. However, they are more easily inactivated by organic material
- Will stain, but not as permanently as iodine.

Chlorine

Used as calcium hypochlorite:

- Used in the environment only – in water supplies, sewage and as a general disinfectant in dairies and animal housing facilities
- Effective on all pathogens, including bacterial spores
- It is highly irritant to tissue, corrosive to metals and often toxic, so its use is limited
- Examples of chlorine halogens are Domestos, Milton and Chloros
- Chlorines are 'bleaches' and are inactivated by organic material and sunlight.

Bromine and fluorine

Both of these are too toxic for medical or veterinary use.

Peroxides

- Used in the environment and on skin
- Effective on bacteria, especially anaerobes
- Oxidizing agents
- Examples are hydrogen peroxide, potassium permanganate, zinc peroxide and Virkon
- Can be used in a number of ways, e.g. as a flush for abscesses (3% solution), to cauterize bleeding or, in the case of Virkon, as an environmental disinfectant.

Phenols

- Phenol is also known as carbolic acid
- An old-fashioned type of disinfectant
- Toxic to cats
- Work by denaturing the cell protein.

The phenol group is divided into:

- **Black/white and clear**
  - Used in the environment only
  - Effective on bacteria, tuberculosis (acid-fast) group of bacteria, viruses and fungi
  - Examples of these are Jeyes fluid and Izal
  - Cheap, strong-smelling and absorbed by rubber and plastic
- **Chloroxylenols (chlorinated)**
  - Used in the environment and on the skin
  - Effective on Gram-positive bacteria
  - An example is Dettol
  - Less irritant than the black/white/clear phenols but more easily inactivated by hard water and organic matter
- **Hexachlorophane**
  - Used in soaps and detergents
  - Effective on Gram-positive bacteria.

Quaternary ammonium compounds (QACs)

- Used in the environment and on the skin
- Effective on Gram-positive and Gram-negative bacteria and, to some extent, bacterial spores, fungi and viruses
- QACs are a type of catatonic detergent that kills pathogens by dissolving lipid in the cell walls and membranes
- Examples are Trigene, Vetaclean, Savlon and Zephiran
- A fairly new group of disinfectants and popular in medicine as they are non-toxic
- Odourless, colourless (unless added for identification) and cheap; however, they are inactivated by hard water, organic matter and soap
- Cotton wool left to soak in a solution of QAC and water will become inactive as the day progresses – always use a fresh solution on each patient.

Disposal of waste

The legal definition of clinical waste is given in the Controlled Waste Regulations 1992 as 'any waste which consists wholly or partly of human or animal tissue, blood or other bodily fluids, excretions, drugs or other pharmaceutical products, swabs or dressings, or syringes, needles or other sharp instruments, being waste which unless rendered safe may prove hazardous to any person coming into contact with it'. This includes waste from medical, nursing, dental, pharmaceutical, teaching, research and veterinary practices.

The Environmental Protection Act 1990 states that 'all establishments are responsible for their own waste' but this was amended in 1992 to include 'a duty of care for controlled waste'. This means that the responsibility for disposing of waste created by a business lies with the employer or self-employed person, which includes ensuring that waste disposed of by an outside company, e.g. collectors of clinical waste from a veterinary practice, is disposed of legally and safely. Should the outside company be found to be negligent according to law, then the people who employ that company are also liable for prosecution.

Within the veterinary practice there must be a waste storage area separate from any other area, which must be secure both against humans and vermin, with access only to authorized personnel. Within the area, the waste is stored in appropriate receptacles ready for disposal and collection by the designated company and vehicle.

There are many different types of waste, which must be disposed of correctly. They can be classed as:

- Hazardous waste – the premises must keep a waste register, use consignment notes and keep these records for 3 years
- Non-hazardous waste.

All waste has an EWC classification number for identification. There is also a colour code system of containers for the disposal of waste. This is as follows:

- Yellow – infectious waste that requires disposal by incineration
- Orange – infectious waste that requires treating to render it safe or incinerated
- Purple – cytotoxic and cytostatic waste
- Yellow and black – offensive or hygiene waste
- Black – domestic waste that cannot be recycled.

Hazardous waste

This group is divided as follows.

Cytotoxic and cytostatic pharmaceuticals (EWC 18 02 07)

This group includes medicinal products which are toxic, carcinogenic and/or mutagenic. Following identification, these may include glass containers, syringes and sharps, animal bedding and clinical items such as swabs and gloves. They must be disposed of by segregating into purple or yellow containers for high-temperature incineration.

Contaminated sharps (EWC 18 02 02 and 18 02 08)

This group includes all sharps contaminated with blood or pharmaceuticals (other than cytotoxic or cytostatic as above). They must be disposed of by segregating into yellow sharps containers for high-temperature incineration. Non-contaminated sharps can be disposed of in orange-lidded containers for treatment such as autoclaving (EWC 18 02 02).

Infectious waste (EWC 18 02 02)

This group includes waste containing microorganisms or their toxins, which are believed to have caused disease in another living organism. Following identification, these may include clinical items such as swabs and gloves, animal bedding and body parts and cadavers.

Photographic chemicals (Fixer EWC 09 01 01 and developer EWC 09 01 04)

This group includes waste fixer and developer solutions. They must be disposed of by segregating into separate containers and treated at a permitted facility which can be arranged via the practice waste contractor. There is no standard packaging.

Non-hazardous waste

This group is divided as follows.

Pharmaceuticals (EWC 18.02.08)

This group does not include cytotoxic or cytostatic pharmaceuticals. It does include controlled drugs, prescription-only medicines, out-of-date drugs and contaminated bottles, syringes and packaging. It can be further divided into:

- **Disposal of controlled drugs** – all controlled drugs should be denatured before disposal with other pharmaceuticals above. Schedule 2 drugs require denaturing in the presence of a person authorized by the Secretary of State, e.g. a police officer
- **Disposal of other pharmaceuticals** – should be segregated into leak-proof containers without mixing them together. There is no standard packaging. They should be incinerated at a permitted facility which can be arranged via the practice waste contractor.

Offensive waste (EWC 18 02 03)

This is soft waste that is not 'clinical waste' but is unpleasant to the senses. It should not present risk of infection or hazard to another living organism. Following identification, this waste may include swabs, gloves and animal bedding. Material containing bodily fluids should not be placed in this waste unless veterinary surgeons can demonstrate that they implemented procedures that ensure the waste does not pose a threat of infection to another living organism. The waste should be segregated into yellow and black containers for disposal into landfill.

Non-infectious cadaver (EWC 18 02 03)

Any pet cadavers that are not infectious can be buried at home, buried in a pet cemetery or cremated. There is no standard packaging and disposal can be arranged via the practice waste contractor.

Domestic waste (EWC 20 03 01)

This group includes domestic waste such as unsoiled newspaper, food waste and other household waste not fit for recycling. This waste goes to landfill.

Further information of the disposal of waste can be found on the BVA website at www.bva.co.uk and in Chapter 3.

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