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EMERGENCIES

Emergency care is just that—care applied to a potentially serious condition as soon as possible while you are trying to reach your veterinarian. One of the cardinal rules in dealing with any emergency is for *you* to remain calm. If you panic, you won't be thinking clearly and you will panic your cat. Take a deep breath, quietly reassure your cat, and then do what is necessary. Don't hesitate to ask for help and remember that your cat is relying on you.

Home Emergency Medical Kit	
Container for equipment	Tweezers
Penlight	Scissors
Blanket	Grooming clippers
Rectal thermometer	Needle-nose pliers
Surgical gloves	K-Y lubricant or petroleum jelly
Cotton balls	Rubbing alcohol
Cotton swabs	Betadine or similar antiseptic scrub
Gauze pads (1 inch, 2.5 cm, square)	Hydrogen peroxide
Gauze roll (1 or 2 inches, 2.5 or 5 cm, wide)	Topical antibiotic ointment
Ace bandage (1 or 2 inches, 2.5 or 5 cm, wide)	Sterile saline eyewash
Surgical adhesive tape (½ or 1 inch, 1.5 or 2.5 cm, wide)	List of emergency phone numbers: Your veterinarian's office 24-hour emergency clinic ASPCA Animal Poison Control Center (888) 426-4435
Syringe (plastic) without a needle	
Compressed activated charcoal tables (5 grams each)	

Handling and Restraint

Any cat, no matter how docile he may be, has the potential to bite when he is severely injured, frightened, or in pain. It is important to recognize this and take proper precautions to keep from being bitten. It is therefore wise to always have control of a cat's head.

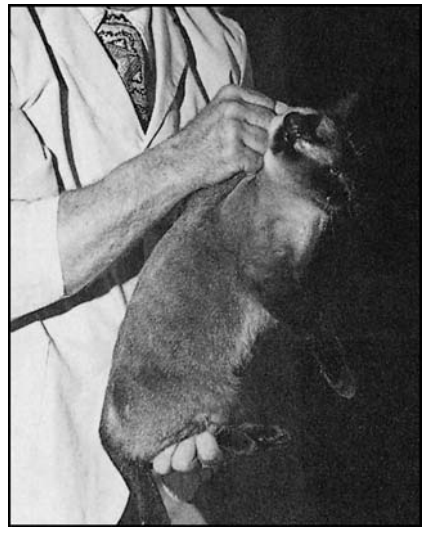
There are several effective ways to handle and restrain a cat. Your choice will depend on whether the individual animal is tranquil and cooperative or frightened and aggressive. Remember that cats have five sets of weapons—one mouth and four feet. They are extremely skilled in using these weapons, and will not hesitate to do so.

Picking Up a Cat

As a general rule, it is advisable to reach down and pick up a cat from above. A face-to-face confrontation might provoke the cat into becoming uncooperative or aggressive.

Cooperative cats can be picked up by placing one hand around the cat beneath the chest and taking hold of the cat's front legs so they cross over each other, keeping your index finger between them for a secure grip. Pick up the cat and snuggle him close to your body, supporting his hind legs if necessary. Cradle his chin with your other hand.

To pick up an apprehensive cat, reach down and grasp him by the scruff of the neck.



Secure the back feet with your other hand.

A leash and loop restraint for an aggressive cat. The cat is immobilized by drawing the leash taut.

To keep the cat from being choked, the loop should include one front leg.

Apprehensive cats can be picked up by reaching down and lifting the cat by the scruff of his neck. Most cats under the age of 1 go limp—as they did when their mothers carried them as kittens. Older cats may not be as cooperative about scruffing. Support the cat's back feet and body with your other hand.

Frightened cats can be picked up by covering the animal with a towel. After a minute or two, as the cat becomes calmer, slide the rest of the towel underneath and lift the cat up as a bundle. This method works for aggressive cats as well, although you may want to wear thick leather gloves and use a thick blanket. It is a good idea to push a slip leash over the cat's head. This way, if he struggles and jumps out of your arms, at least he cannot completely escape.

Aggressive cats can be picked up by slipping a leash or a loop of rope over the cat's head and one front leg. Then lift the animal by the leash and set him down on a table or into a cat carrier or box. Do not attempt to lift the cat simply with a loop around his neck. This method should be used *only as a last resort* (when the method above doesn't work), because it is certain to agitate the cat further.

Another option is to use a small squeeze cage or squeeze box. The cat is lured into a special box that can be tightened gently around the body to allow for injections and a minimal physical exam. A fishing net can also be used to contain the cat, but beware of claws reaching through!

Restraining for Treatment

When the cat is cooperative, routine procedures such as grooming, bathing, and medicating the cat are best carried out in quiet surroundings with a minimum of physical restraint. Approach the cat with confidence and handle him gently. If you are calm and go about this matter-of-factly, most cats handle moderate restraint and treatments reasonably well. Many can be coaxed into accepting the procedure and do not need to be restrained.

Cooperative cats can be lifted onto a smooth, raised surface, such as a tabletop or a high tier of a cat tree. The cat will be less secure—but still not frightened. Speak in a calm, soothing voice until the cat relaxes. Rubbing the ears and scratching the head will calm many cats. Place one hand around the front of the cat's chest to keep him from moving forward. Use your other hand to administer treatment.

Some cats are quite cooperative while being held by the scruff of the neck. However, some cats will object strenuously.

A cat bag restraint may be useful for treating the head, but some cats really hate getting into them.

Simply wrapping the cat in a towel is often the easier solution. Some veterinary hospitals transport their cats around the hospital this way.

Uncooperative cats can be handled in several ways, depending on the degree of agitation. If the cat is cooperative enough to permit handling. Some cats respond with quiet to simply having the scruff held and gently tugged back and forth or holding the scruff and gently tapping on the head as a distraction. This is more likely to be true for cats under age 1. If this is not the case, hold the scruff and press firmly against the top of the table so that the cat stretches out. These actions will prevent you from being scratched by the cat's rear claws.

When help is available, have your assistant stand behind the cat and place both hands around the cat's neck or front legs while pressing their arms against the cat's sides. Wrapping a towel or blanket around the cat has a calming effect and is useful for short procedures such as giving medication. An assistant is required to steady the cat and hold the wraps in place.

A coat sleeve makes an excellent restraint. The cat will often scoot into it willingly. Hold the end of the sleeve securely around the cat's neck. Now you can treat the head or tail.

Cat bags are special bags made for restraining cats. You place the cat on the unzipped bag, then quickly zip it around his body up to his neck. Some veterinarians really like them. However, cat bags are widely disliked by cats, and they struggle about getting into it and may not be calm once inside. An easier solution may be to simply wrap the cat in a towel.

There are also muzzles made especially for cats. These have a cloth circle to enclose the muzzle and, usually, a snap lock strap to go behind the ears.

An assistant is required to restrain a cat this way for a short procedure.

When procedures take longer and the cat cannot be managed by the methods just described, lift the cat straight up from behind by the scruff of the neck with one hand and hold his rear paws together with the other. Press down firmly on the table so the cat is lying on his side with his body extended. Now have an assistant hold the front legs together in one hand and the back legs together in the other hand, as shown in the photo on page 6.

If you don't have an assistant, you may bind the front legs together with something soft, such as a bandana, taking two or three turns below the elbows and tying it off securely. Secure the rear legs by wrapping another bandana above the hocks. Calm the cat by covering his head with a towel or cloth. Do not leave a cat alone when restrained like this.

When properly restrained, cats usually settle down and accept the treatment. Once released, most soon forget the unpleasant experience. Some cats will turn and strike as soon as they are released, however, so be prepared.

If the cat is truly upset, consider sedation for any involved treatments he needs. The risks of sedation may be minimal in a healthy cat, compared to the stress of fighting him for treatment. There are also special restraint cages, usually used by veterinarians and humane societies to handle feral or extremely agitated cats. Ask your veterinarian about these.

RESTRAINING COLLARS

An Elizabethan collar, named for the high neck ruff popular during the reign of Queen Elizabeth I of England, is a useful device to keep a cat from scratching at the ears and biting at wounds and skin problems. Older models are made of hard plastic, but newer ones are softer and more flexible, making them less annoying for the cat. These collars can be purchased from pet supply stores and some veterinarians may loan them out with a deposit. Make sure the collar is not too tight around the cat's neck.

The newer Elizabethan collars are softer and less annoying for the cat than hard plastic models.

The BiteNot collar may be more comfortable for a cat than an Elizabethan collar.

A newer option is the BiteNot collar. This high-necked collar prevents a cat from turning his head to bite. As with an Elizabethan collar, good fit is important. The collar must be just as long as the cat's neck.

Another option is a neck collar, which is simply a wide collar made of flexible cardboard that is taped around the neck. The collar should be about 2 or 3 inches (5 or 8 cm) wide, so that the cat is comfortable, but cannot bend his head and neck all the way down. Be sure to pad the area around the neck to prevent sores and irritation.

Many cats cannot or will not drink water or eat while wearing any type of restraining collar. In that case, temporarily remove the collar several times each day and monitor the cat. Cats with restraining collars must be kept indoors.

Transporting an Injured Cat

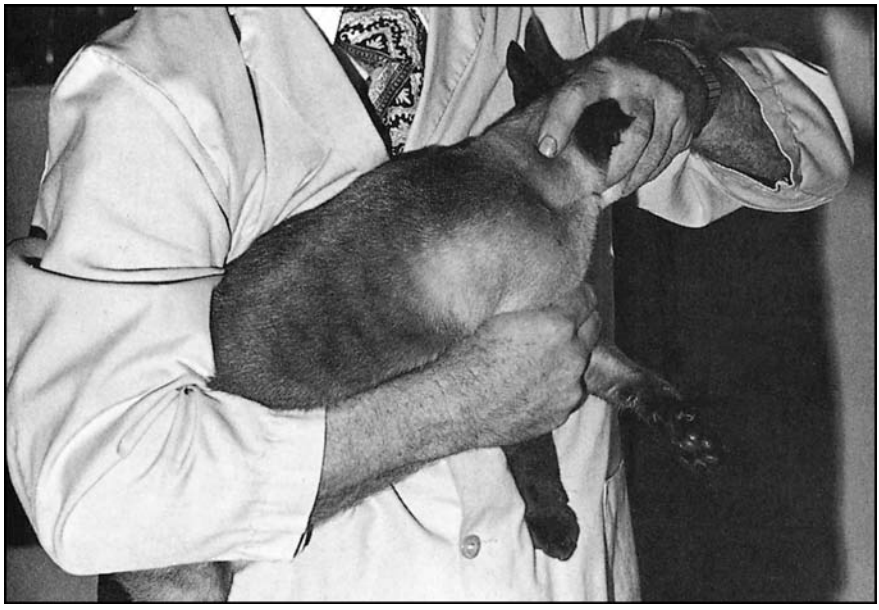
No matter how docile by basic nature, *any cat in pain may scratch or bite*. Proper handling will prevent injuries. Furthermore, struggling can cause a weak or injured cat to tire quickly and can induce shock and collapse.

If you are able to handle the cat, pick him up as described in *Cooperative Cat* (page 2), then settle him over your hip so his rear claws project out behind you where they can do no harm. Press the inside of your elbow and forearm against the cat's side, holding him firmly against your body.

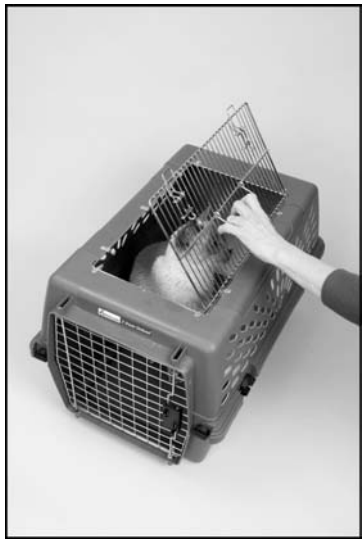
If the cat is frightened or in pain, take precautions to avoid injury. Lift the cat at once from behind by the nape of the neck, support his body underneath, and lower him into a cat carrier or a cloth bag such as a pillowcase. The material must not be airtight, or the cat will smother.

If you have a blanket or towel, throwing this over the cat and then scooping him up often works well. Make sure the cat can breathe. To transport the cat, lower him, towel and all, into a carrier or box. *Transport the cat to the veterinary hospital.*

A cat with a possible back injury should be carried on a piece of stiff cardboard or small wooden board or stretcher. Masking tape can be stretched over the cat to hold him on the stretcher or a blanket can be wrapped around the stretcher and cat to hold him securely.



If you can safely handle the injured cat, hold him firmly against your body with his rear feet pressed out behind. Cover his eyes and ears with your other hand to help calm him.



This carrier loads from the top or the side. It's a lot easier to lower an uncooperative cat in from the top than it is to push him in from the side.

If you don't have a carrier, lift the cat as described in the text on page 8 and lower him into a sack or a pillowcase.

Artificial Respiration and Heart Massage

Artificial respiration is an emergency procedure used to exchange air in an unconscious cat who's not breathing. Heart massage is used when no heartbeat can be heard or felt. When heart massage is combined with artificial respiration, it is called *cardiopulmonary resuscitation (CPR)*. When a cat stops breathing, heart function soon also stops, and vice versa. It is therefore important to know both aspects of CPR. CPR can be performed by one person, but it is easier if two people are available. One does the breathing and the other does the heart massage.

The following emergencies may require artificial respiration or CPR:

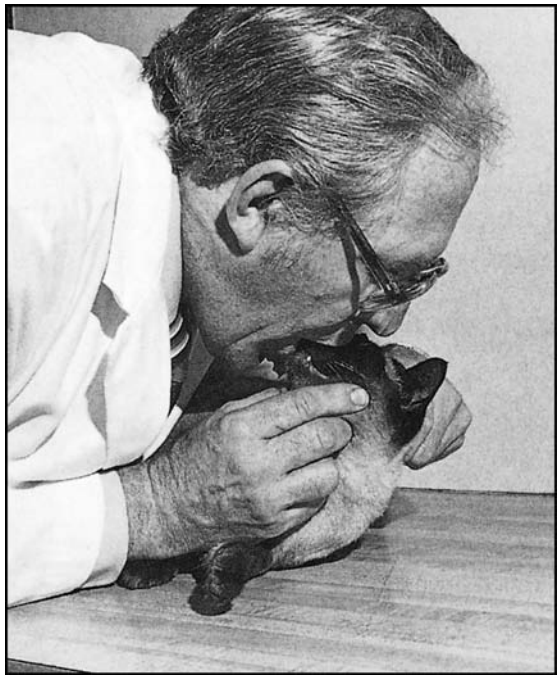
Coma
Electric shock
Head injury
Metabolic problems
Obstructed airway (choking)
Poisoning
Prolonged seizure
Shock
Sudden death
Trauma

Before you begin any emergency aid, you need to determine how much help your cat needs and of what type. If your cat is awake and resists any of this treatment, he does not need it.

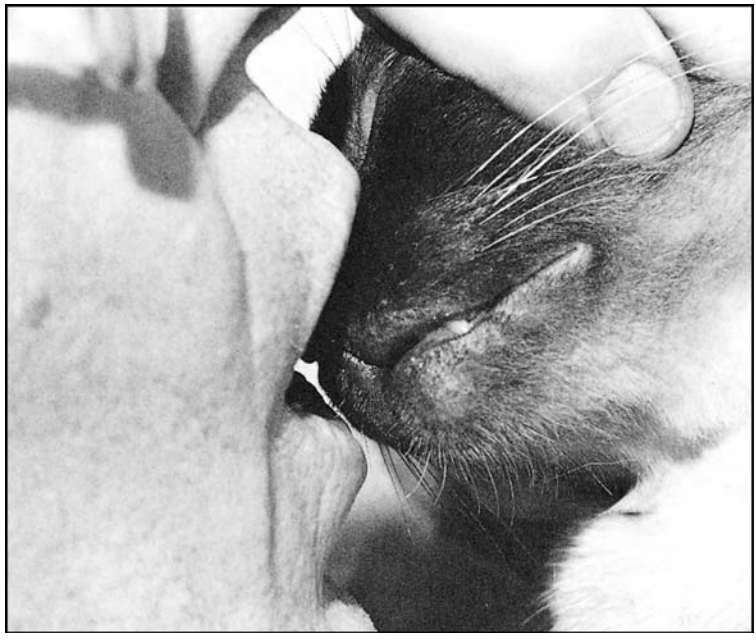
Artificial Respiration or CPR?	
Is the cat breathing? Observe the rise and fall of the chest. Feel for air against your cheek.	If **YES,** pull out the tongue and clear the airway. You may need to clear the airway by gently opening the mouth and wiping with your finger to be sure nothing is stuck or collecting in the mouth or opening to the airway, such as vomit. Observe the cat. If **NO**, feel for a pulse.
Does the cat have a pulse? Feel for the femoral artery located in the groin. Or feel the chest carefully to detect a heartbeat. Put your hand under and around the cat's chest and compress very lightly to feel for a heartbeat.	If **YES**, start artificial respiration. If **NO**, start CPR.

ARTIFICIAL RESPIRATION

1. Lay the cat on a flat surface with his *right* side down.
2. Open his mouth and clear any secretions with a cloth or handkerchief. Check for a foreign body. If present, remove it if possible. If it is impossible to reach or dislodge, perform the *Heimlich Maneuver*, described on page 33.
3. Pull the tongue forward and close the mouth. Place your mouth over the cat's nose (but not the mouth). Blow gently into the cat's nostrils. The chest will expand. Remember, *gentle* blowing—you should not be blowing hard enough to inflate a balloon.
4. Release to let the air come back out. Excess air will escape through the cat's lips, preventing overinflation of the lungs and overdistension of the stomach.
5. If the chest does not rise and fall, blow more forcefully; or, if necessary, lightly seal the lips with your hand.
6. The rate is one breath every four to five seconds (12 to 15 per minute).
7. Continue until the cat breathes on his own, or as long as the heart continues to beat.



Artificial respiration. Blow gently into the cat's nostrils.



In this close view, you can see how leaving the mouth uncovered avoids the problem of overinflation.

CPR

CRP is a combination of artificial respiration and heart massage. If a cat needs heart massage, he also needs artificial respiration. On the other hand, if the cat resists your attempts to perform CPR, he probably does not need it!

1. Continue with mouth-to-nose breathing.
2. Prepare for heart massage. Place your fingers and thumb on either side of the cat's sternum or chest, behind his elbows.
3. Compress the chest firmly 6 times; administer a breath. Then repeat. Massage rate is 80 to 120 compressions per minute.
4. If possible, do not stop heart massage while administering a breath.
5. Pause every 2 minutes for 10 to 15 seconds to check for a pulse and spontaneous breathing.
6. Continue until the heart beats and the cat breathes on his own, or until no heartbeat is felt for 30 minutes.

For heart massage, place the fingers and thumb on either side of the sternum behind the cat's elbows.

Shock

Shock is caused by insufficient blood flow and oxygen to meet the body's needs. Adequate blood flow requires effective heart pumping; open, intact blood vessels; and sufficient blood volume to maintain flow and pressure. Adequate oxygenation requires an open respiratory tract and enough energy to breathe. Any condition that adversely affects the circulatory or respiratory systems, making these things impossible, can cause shock.

The cardiovascular system of an animal in shock will try to compensate for inadequate oxygen and blood flow by increasing the heart and respiratory rates, constricting the skin's blood vessels, and maintaining fluid in the circulation by reducing urinary output. This requires additional energy at a time when the vital organs aren't getting enough oxygen to carry out normal activities. After a time, shock becomes self-perpetuating. Untreated, it results in death.

Common causes of shock are dehydration (often caused by prolonged vomiting and diarrhea), heat stroke, severe infections, poisoning, and uncontrolled

bleeding. Falling from a height or being hit by a car are the most common causes of traumatic shock in cats.

Signs of early shock include panting, rapid heart rate, bounding pulse, and a bright red color to the mucous membranes of the lips, gums, and tongue. Many of these signs will be missed or considered mild—perhaps looked at as a cat who overexerted himself or is very excited. The later signs are when most owners notice and respond to their cat's condition. Signs of late shock (the ones seen most often) are pale skin and mucous membranes, a drop in body temperature, cold feet and legs, a slow respiratory rate, apathy and depression, unconsciousness, and a weak or absent pulse.

Treatment: First, evaluate. Is the cat breathing? Does he have a heartbeat? What is the extent of his injuries? Is the cat in shock? If so, proceed as follows:

1. If the cat is not breathing, proceed with *Artificial Respiration* (page 11).
2. If there is no heartbeat or pulse, administer *CPR* (page 12).
3. If the cat is unconscious, check to be sure the airway is open. Clear secretions from the mouth with your fingers. Pull out the tongue to keep the airway clear of secretions. Keep the head lower than the body.
4. Control bleeding (as described in *Wounds*, page 48).
5. To prevent further aggravating the shock:
   - Calm the cat, and speak soothingly.
   - Allow your cat to assume the most comfortable position. An animal will naturally adopt the one that causes the least pain. Do not force the cat to lie down—this may make breathing more difficult.
   - When possible, splint or support broken bones before moving the cat (see *Broken Bones*, page 16).
   - Wrap the cat in a blanket to provide warmth and to protect injured extremities. (How to handle and restrain an injured cat for transport to the veterinary hospital is discussed in *Handling and Restraint*, page 2.) Do not attempt to muzzle the cat, as this can impair breathing.
6. Head for the nearest veterinary hospital.

ANAPHYLACTIC SHOCK

Anaphylactic shock is an immediate, serious allergic reaction. It occurs when a cat is exposed to an *allergen* to which he has been sensitized. Sensitivity occurs through prior contact.

The most common drug allergen that causes anaphylactic shock is penicillin. The venom in the stings of bees and wasps can also occasionally produce anaphylactic shock. Some cats have been known to experience shock after a vaccination, although this is not common.

Anaphylactic shock causes signs and symptoms different from those described in the previous section on shock. Initially, there may be local signs at the point of contact, including pain, itching, swelling, and redness of the skin. With acute anaphylaxis, the allergic response becomes generalized, either immediately or over the course of several hours. Signs are agitation, diarrhea, vomiting, difficulty breathing, *stridor* (harsh breathing sounds) from a swollen larynx, weakness, and circulatory collapse. In untreated cases, coma and death follow.

Treatment: Emergency treatment of anaphylactic shock involves administering adrenaline (epinephrine), oxygen, antihistamines, IV fluids, and hydrocortisone—drugs that are not available at home. This is why it is best to have your veterinarian give vaccines—he or she has the drugs and equipment to treat allergic reactions in time.

A cat who has had an allergic reaction to a drug in the past should not be given that drug again. (Also see *Insect Stings*, page 43.)

Acute Painful Abdomen

An acute abdomen is an emergency that can lead to death unless treatment is started as soon as possible. The condition is characterized by the sudden onset of abdominal pain along with vomiting, retching, extreme restlessness and inability to find a comfortable position, purring, meowing, crying, grunting, and labored breathing. The abdomen is extremely painful when pressed. A characteristic position is sometimes seen in which the cat rests his chest against the floor with his rump up in the air. As the condition worsens, his pulse becomes weak and thready, his mucous membranes appear pale, and he goes into shock.

One of the following may be the cause:

- Urinary tract obstruction
- Blunt abdominal trauma (such as being kicked or hit by a car) with internal bleeding
- Rupture of the bladder
- Perforation of the stomach and/or intestines
- Poisoning
- Rupture of a pregnant uterus

A painful abdomen indicates the need for immediate veterinary attention.

- Acute peritonitis
- Intestinal obstruction

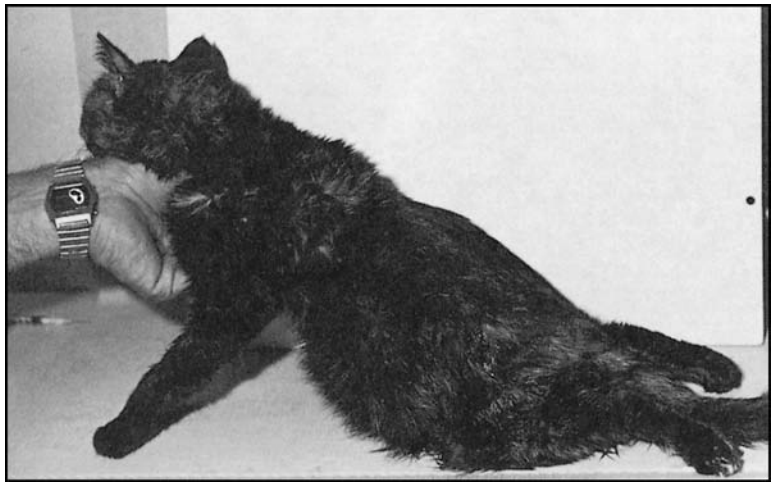
A cat with an acute abdomen is critically ill and needs *immediate* veterinary attention.

Broken Bones

Most broken bones are caused by automobile accidents and falls. Falls from apartment windows are most common in warm weather, when a screen is left open or the weight of the cat pushing on it removes the screen. The bones most commonly broken are the femur, pelvis, and jaw. Fractures of the skull and spine occur less frequently. A rather common type of fracture occurs when a car runs over a cat's tail; it is discussed in *Spinal Cord Injuries* (page 343).

Fractures are classified by type and whether the injury involves a break in the skin. Young bones tend to crack and these are called greenstick fractures, whereas the bones of elderly cats are brittle and are more likely to break.

Complete breaks are classified as open or closed. In a closed fracture, the bone does not break through the skin. In an open fracture, the bone makes contact with the outside, either because of a deep laceration exposing it or because the point of the bone protrudes through the skin. Open fractures are associated with a high incidence of bone infection.



A cat with a pelvic fracture is unable to bear weight on his rear legs. This might be confused with a spinal cord injury or arterial thromboembolism.

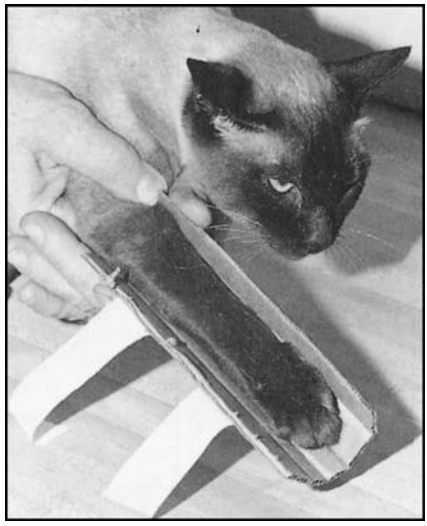
Treatment: Many of these injuries are accompanied by shock, blood loss, and injuries to other organs. Controlling shock takes precedence over treating the fracture (see *Shock*, page 15). Cats with injury or pain should be handled gently, as described in *Handling and Restraint* (page 2). Take precautions to avoid a scratch or bite.

Fractures should be immobilized to prevent further injury as you transport the cat to a veterinary hospital. Splint the involved limb. A satisfactory splint is one that crosses the joint above and below the injury. When the fracture is below the knee or elbow, immobilize the limb by folding a magazine or piece of thick cardboard around the leg. A toilet paper cardboard roll is often the right size. Then wrap it with gauze, a necktie, or tape.

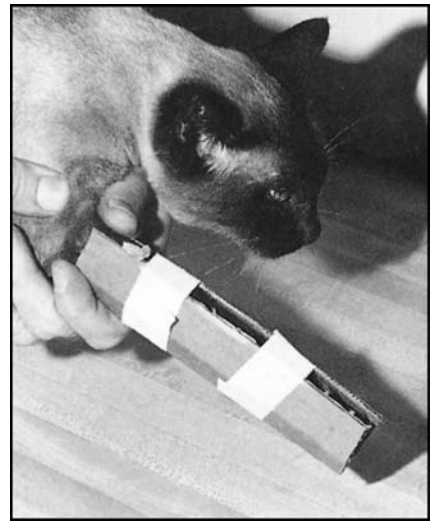
Limb fractures above the knee or elbow are immobilized by binding the leg to the body. Sometimes it is best to simply wrap the cat gently in a blanket or towel, with the injured leg close to his body. Then have someone hold the cat as still as possible while another person drives to the veterinary hospital.

If the bone is completely broken and the ends are displaced, your veterinarian will need to reduce the fracture and return the ends of the bones to their original position. Reduction is done by pulling on the limb to overcome the muscle spasm that caused the shortening. Obviously, this requires general anesthesia. Once reduced, the position of the bones must be maintained. In general, fractures above the knee or elbow are stabilized with pins and metallic plates, while those below are immobilized with splints and casts.

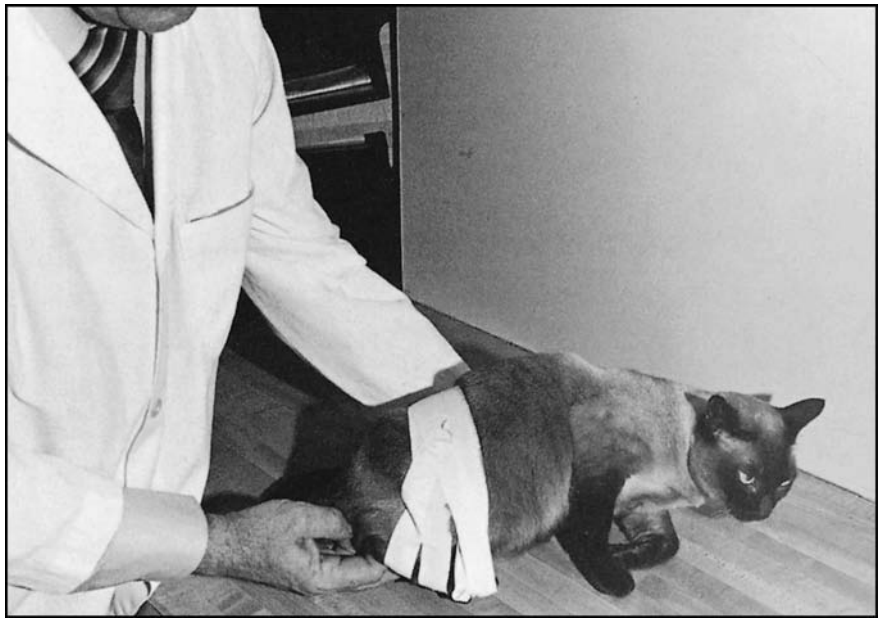
Displaced jaw fractures can cause malposition of the teeth. The jaw should be adjusted and the teeth wired together to maintain the correct position until healing is complete. Skull fractures may require surgery to elevate the depressed fragment. For more information, see *Head Injuries* (page 330).



A piece of cardboard makes a good temporary splint.



Use it for fractures of the front leg below the elbow.



Fractures above the knee joint can be immobilized by taping the leg to the body.

The fractured lower jaw shows separation of the two sides. These injuries commonly follow blows to the head.

Burns

Burns are caused by heat, chemicals, electric shocks, or radiation. Sunburn is an example of a radiation burn. It occurs on the ear flaps of cats with white coats or white noses (see *Sunburn*, page 211), and on the skin of white-coated cats who have been clipped down. A cat may be scalded by having hot liquid spilled on him or by being involved in some other household accident. A common type of burn occurs on the foot pads after walking on a hot surface such as a tin roof, stove top, or freshly tarred road.

The depth of injury depends on the length and intensity of exposure.

A first-degree burn causes the skin to become red, slightly swollen, and painful. You will see redness of the skin, occasionally blistering, perhaps slight swelling, and the burn area is tender. These superficial burns usually heal in about five to seven days.

A second-degree burn is deeper and there is blistering. These burns are extremely painful. These wounds may take up to 21 days to heal, or longer if the area gets infected.

A third-degree burn involves the full thickness of skin and extends into the subcutaneous fat. The skin appears white or leathery, the hair comes out easily when pulled, and pain is severe initially, but fades if nerve endings are

destroyed. These burns penetrate the outer layers of the skin. Since nerve endings are usually destroyed, these burns are often not as painful as second-degree ones. If more than 20 percent of the body surface is deeply burned, the outlook is poor. Fluid loss is excessive. Shock can occur and infection is likely because skin defenses are gone.

Treatment: If your cat appears to be suffering from electrical shock, use a wooden implement to slide any power cords away from him before you touch him. Alternatively, unplug all cords or turn off the circuit breakers so that you won't get a shock too.

Most burns should receive veterinary attention. Fluid loss, shock, and possible infection can be life-threatening complications of all but minor burns. *Do not* put butter or any greasy ointment on the burns. Cover with damp gauze and head to your veterinarian.

For minor burns, apply cool compresses (not ice packs) to damaged areas for 30 minutes to relieve pain. Replace as the compress becomes warm. Clip away the hair and wash the area gently with a surgical soap. Blot dry. Apply Silvadene cream or triple antibiotic ointment. Protect the area from rubbing by wrapping it with a loose-fitting gauze dressing. This bandage should be changed at least once every day so the area can be cleaned and treated. Do not using a rubbing action on damaged skin.

Treat acid, alkali, gasoline, kerosene, and other chemical burns by flushing with large amounts of water for 10 minutes. Do not let your cat groom these substances off his coat. Wear gloves and bathe the cat with mild soap and water. Blot dry and apply antibiotic ointment. Bandage loosely. If you see signs of obvious burns, such as blistering, you need to contact your veterinarian. Along with burns, some of these substances can cause toxicity.

Cats should not be allowed to groom near burned areas of skin. It may be necessary to have the cat wear an Elizabethan collar or a BiteNot collar (see page 7) to prevent grooming. Alternatively, if the area is small, it can be bandaged to keep the cat from licking it. (Mouth burns from electric cords are discussed on page 235.)

Cold Exposure

HYPOTHERMIA (LOW BODY TEMPERATURE)

Prolonged exposure to cold results in a drop in body temperature. This is most likely to occur when a cat is wet. Hypothermia also occurs with shock, after a long period under anesthesia, and in newborn kittens. (How to warm a chilled kitten is discussed in *Warming a Chilled Kitten*, page 456.) Prolonged chilling burns up the available energy in the body and predisposes the cat to low blood sugar.

The signs of hypothermia are violent shivering followed by listlessness and lethargy, a rectal temperature below 97°F (36°C), and finally, collapse and coma. Hypothermic cats can withstand extended periods of cardiac arrest because the low body temperature lowers the metabolic rate. CPR may be successful in such cases.

Treatment: Wrap your cat in a blanket or coat and carry him into the house. If the cat is wet (having fallen into icy water or been out in cold rain), give him a warm bath. Rub vigorously with towels to dry the skin.

Warm a chilled cat by applying warm water packs, wrapped in towels, to the armpits, chest, and abdomen. The temperature of the pack should be about that of a baby's bottle—warm to the wrist. Take the cat's rectal temperature every 10 minutes. Continue to change the packs until the rectal temperature reaches 100°F (37.8°C). Do not warm the cat with a hair dryer, which may cause burns.

As the cat begins to move about, give him some honey or a few spoonfuls of a glucose solution—made by adding 4 teaspoons of sugar to a pint of warm water (7 g of sugar added to 500 ml of warm water). If your cat won't drink or lick it, dab a bit of honey or Karo syrup on his gums.

FROSTBITE

Frostbite is damage to the skin and underlying tissues caused by extreme cold. It often accompanies hypothermia. It most commonly involves the toes, ears, scrotum, and tail. (Frostbite of the ear flaps is discussed on page 211.) These areas are the most exposed and are only lightly protected by fur. At first, frostbitten skin is pale and white. With the return of circulation, it becomes red and swollen. Later it may peel. Eventually, it looks much like a burn, with a line of demarcation between live and dead tissue. The dead area will turn dark and become hardened and brittle. The actual extent of the damage may not be apparent for a week or more. The dead skin separates in one to three weeks.

Treatment: Warm frostbitten areas by immersing in warm (not hot) water for 20 minutes or until the tissue becomes flushed. *Never apply snow or ice.* Tissue damage is greatly increased if thawing is followed by refreezing. Do not rub or massage the affected parts, because the damaged tissue is easily destroyed. Your cat should be taken to the veterinarian for follow-up care. Topical or oral antibiotics may be prescribed.

As sensation returns to the cold areas, they may be painful. Do not let your cat excessively groom those areas or chew on them.

Dehydration

Dehydration occurs when your cat loses body fluids faster than he can replace them. Usually it involves loss of both water and *electrolytes* (which are minerals such as sodium, chloride, and potassium). If the cat is ill, dehydration may be due to an inadequate fluid intake. Fever increases the loss of water. This becomes significant if the cat does not drink enough to offset the loss. Other common causes of dehydration are prolonged vomiting and diarrhea.

One sign of dehydration is loss of skin elasticity. When the skin along the back is pinched up into a fold, it should spring smoothly back into place. In a dehydrated cat, the skin stays up in a ridge. Another sign is dryness of the mouth. The gums, which should be wet and glistening, are dry and tacky to the touch. The saliva is thick and tenacious. Late signs are sunken eyeballs and shock.

Treatment: A cat who is noticeably dehydrated should receive prompt veterinary attention. Treatment involves replacing fluids and preventing further losses.

In mild cases without vomiting, fluids can be given by mouth. Make sure fresh, clean water is always available for your cat to drink on his own. If the cat won't drink, give him an electrolyte solution by bottle or syringe into the cheek pouch (see page XX for advice on administering liquids to your cat). Balanced electrolyte solutions for treating dehydration in children are available at drugstores. Ringer's lactate, with 5 percent dextrose in water, and Pedialyte are both suitable for cats. These solutions should only be given orally. They are given at the rate of 2 to 4 milliliters per pound (.5 k) of body weight per hour, depending on the severity of the dehydration (or as directed by your veterinarian).

Many cats will need subcutaneous or intravenous fluids administered at the veterinary hospital. Secondary kidney failure can occur as a result of severe dehydration. (Treating dehydration in infant kittens is discussed in *Common Feeding Problems*, page 466.)

Drowning and Suffocation

Conditions that prevent oxygen from getting into the lungs and blood cause asphyxiation or suffocation. These include carbon monoxide poisoning, inhaling toxic fumes (smoke, gasoline, propane, refrigerants, solvents, and others), drowning, and smothering (which can happen when a cat is left too long in an airtight space). Other causes include foreign bodies in the airways and injuries to the chest that interfere with breathing.

A cat's collar can get snagged on a fence, and the cat can strangle while struggling to get free. Be sure to provide an elastic collar that can stretch and slip over your cat's head in an emergency, or a breakaway collar with a special quick-release clasp.

Cats are natural swimmers and can negotiate short distances well. However, they can't climb out of water if the sides are steep or over a ledge. They might drown in a swimming pool if a ramp exit is not provided or if they panic and can't find the ramp and swim to exhaustion. They can also drown in a pond if they break through ice and can't get out.

The symptoms of oxygen deprivation, also called *hypoxia*, are straining to breathe, gasping for breath (often with the head extended), extreme anxiety, and weakness progressing to loss of consciousness as the cat begins to succumb. The pupils begin to dilate. The tongue and mucous membranes turn blue, also called *cyanosis*, which is a sign of insufficient oxygen in the blood.

One exception to the blue color is carbon monoxide poisoning, in which the membranes are a bright red. Carbon monoxide poisoning can be seen in cats rescued from burning buildings, trapped in car trunks, or left in a closed garage with an engine running.

Treatment: The most important consideration is to provide your cat with fresh air to breathe. (Better yet, give oxygen if it is available.) If respiration is shallow or absent, immediately give artificial respiration (see page 11). Get the cat to the nearest veterinary hospital—ideally, with one person driving while another gives respiratory support.

Carbon monoxide poisoning is frequently associated with smoke inhalation and burns of the mouth and throat. Carbon monoxide binds with hemoglobin in the blood and blocks the delivery of oxygen to the tissues. Even though the cat is breathing deeply, oxygen transport will be compromised for several hours. Breathing a high concentration of oxygen helps to overcome these effects. A veterinarian will be able to provide this therapy using an oxygen mask, a nasal tube, or an oxygen cage.

If the cat has a *pneumothorax,* an open wound into the chest (which you can determine if you hear air sucking in and out as the cat breathes), seal off the chest by pinching the skin together over the wound. Maintain this seal with a bandage wrapped around the chest or a gauze pad held firmly against the chest wound while transporting the cat to the veterinarian. For drowning, first you want to remove as much water as possible from the lungs. Hold the cat upside down by placing your hands around his lower abdomen, and gently swing the cat back and forth for 30 seconds while supporting the head. Then position the cat on his right side with the head lower than the chest and begin artificial respiration (see page 11). If there is no pulse or discernible heartbeat, heart massage should be attempted (see *CPR,* page 12). Continue efforts to resuscitate until the cat breathes without assistance or until no heartbeat is

felt for 30 minutes. Remember, cats who have been in cold water or cold temperatures can often be resuscitated even after a long time.

Once the immediate crisis is over, veterinary aid should be sought. Pneumonia from inhalation is a frequent complication.

Electric Shock

Electric shocks can be caused by chewing on power cords or coming in contact with downed wires. A shock can cause involuntary muscle contractions of the jaw that may prevent a cat from releasing the live wire. Lightning strikes are almost always fatal, and leave behind the telltale signs of singed hair and skin.

Cats who receive an electric shock may be burned, or the shock may cause an irregular heartbeat with signs of circulatory collapse. Electric current also damages the capillaries of the lungs and leads to *pulmonary edema*, which is the accumulation of fluid in the air sacs. The signs are straining to breathe, gasping for breath (often with the head extended), extreme anxiety, and weakness progressing to loss of consciousness as the cat begins to succumb. If the cat bit into a cord, you may see drooling, ulcers or burns on the lips, and coughing from lung damage.

Treatment: If your cat is found in contact with an electric cord or appliance, or downed wires, *do not touch the cat*. If possible, throw the circuit breaker or pull out the plug. Or use a wooden stick or broom handle to move the live cord away from the cat. If the cat is unconscious and is not breathing, administer artificial respiration (see page 11). Pulmonary edema must be treated by a veterinarian, and any cat with an electrical shock should be seen by a veterinarian.

Treat any burn as described in *Burns* (page 19). Mouth burns from electric cords are discussed on page 235.

Prevention: Try to move electric cords out of the way to minimize the chances of your cat playing with them. This is especially true with kittens. Try tacking the cords to the wall or enclosing them in plastic sleeves or lengths of hose.

Heat Stroke

Heat stroke is an emergency that requires immediate recognition and prompt treatment. Cats do not tolerate high temperatures as well as humans do. They sweat very minimally through their paws, and instead depend on rapid breathing to exchange warm air for cool air. Heat-stressed cats drool a great

deal and lick themselves to spread the saliva on their coats, because the evaporation of saliva is an important additional cooling mechanism. But when air temperature is close to body temperature, cooling by evaporation is not an efficient process. Cats with airway disease also have difficulty with excess heat.

Common causes of overheating or heat stroke include

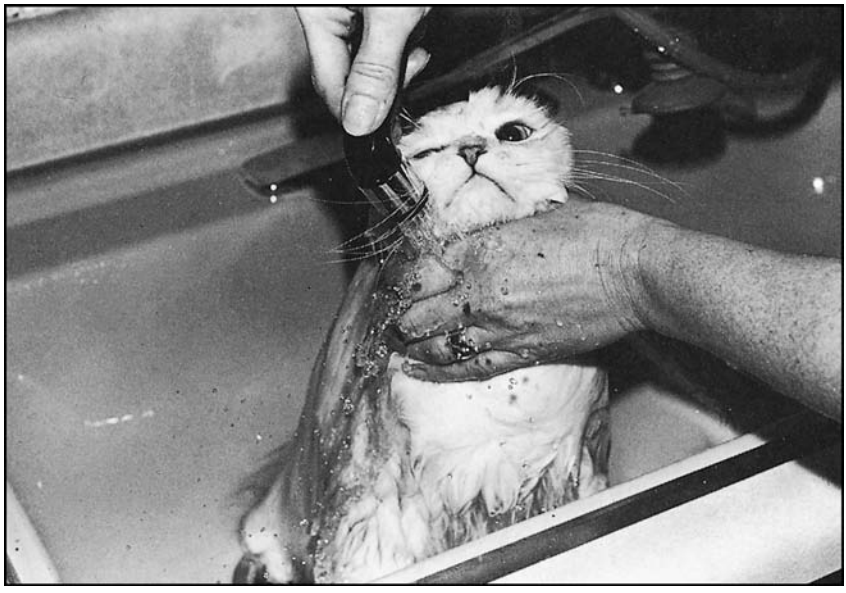
- Increased environmental temperature, such as being left in a car in hot weather or being confined to a crate without water
- Airway disease that interferes with heat dissipation through rapid breathing
- Heart or lung disease that interferes with efficient breathing
- Excessive heat production caused by high fever, seizures, or strenuous exercise

Heat stroke begins with rapid, frantic, noisy breathing. The tongue and mucous membranes are bright red, saliva is thick and tenacious, and the cat often vomits. His temperature, as measured with a rectal thermometer, rises, sometimes to over 106°F (41°C). The problem is usually evident by the appearance of the cat. The condition can be confirmed by taking the animal's temperature.

If heat stroke goes untreated, the cat becomes unsteady and staggers, has diarrhea that is often bloody, and becomes progressively weaker. His lips and mucous membranes become a pale blue or gray. Collapse, coma, and death ensue.

Treatment: *Emergency measures must begin at once*. Take the rectal temperature every 10 minutes. Mild cases respond by moving the cat to cooler surroundings, such as an air-conditioned building or car. If the cat's temperature is over 106°F (39.4°C) or if the cat becomes unsteady, apply wet, cold towels to the armpits and groin, as well as on the head, or immerse the cat's body (not the head) in cool water until the rectal temperature reaches 103°F. As an alternative, wet the cat down with a garden hose. Ice packs can be applied to the head and the groin area. Stop the cooling process and dry the cat when the temperature falls below 103°F. The thermoregulatory system is not functioning normally, and further cooling may produce hypothermia.

Any cat with suspected heat stroke should be seen by a veterinarian. Delayed and secondary problems can include kidney failure, cardiac arrhythmias, and seizures. Heat stroke can also be associated with swelling of the throat. This aggravates the problem. A cortisone injection from your veterinarian may be required to treat this.



Heat stroke is an emergency. Cool the cat with a cool water spray or immerse him in a tub of cool water.

Prevention:

- Do not expose cats with airway disease or impaired breathing to prolonged heat.
- Do not leave a cat in a car with the windows closed, even if the car is parked in the shade.
- If traveling in a car, keep the cat in a well-ventilated cat carrier, or better yet, an open wire cage, so the car windows can be left open.
- Provide shade and cool water to cats who spend time outdoors in runs.
- Take extra precautions in hot, humid weather and with cats who have shortened faces and muzzles, such as Persians.

Poisoning

A poison is any substance that is harmful to the body. This includes manufactured products such as prescription drugs and cleaning solutions, and also natural herbs and other plants. Their innate curiosity may lead cats to lick or taste things that are poisonous. Fastidious grooming may cause a cat to lick poisonous products from his coat.

Animal baits are palatable poisons that encourage ingestion. This makes them an obvious choice for intentional poisoning. Cats may also be unintentionally poisoned by these products if they eat a rodent who has ingested poisoned bait. (Remember that even indoor cats may hunt and kill small prey animals—rodents, insects, or small reptiles.)

Most cases suspected of being malicious poisoning actually are not. Cats, by nature, are curious and have a tendency to explore out-of-the-way places such as wood piles, weed thickets, and storage areas. They also hunt small animals, often chasing them into confined spaces. These environments put cats into contact with insects, dead animals, and toxic plants. It also means that in many cases of suspected poisoning, the actual agent will be unknown. The great variety of potentially poisonous plants and shrubs makes identification difficult or impossible, unless you have direct knowledge that the cat has eaten a certain plant or product.

Many cases of poisoning occur in the home or in the garage. Potentially poisonous substances should be kept in secure containers and, ideally, in cupboards that close securely (remember that prying paws can open some cupboard doors). Poisonous houseplants can be removed and outdoor plants removed or fenced off from pets. Keep medications in childproof containers and inside secure cupboards.

The Top Ten Poisonings in Cats

According to the ASPCA Animal Poison Control Center, these are most common poisonings that occur among cats.

1. Permethrin insecticides designed for dogs; never use dog flea and tick products on cats!
2. Other topical insecticides; follow directions carefully.
3. Venlafaxine, a human antidepressant that goes by the brand name Effexor; apparently, cats are attracted to the capsules.
4. Glow jewelry and sticks; the liquid inside is mildly toxic.
5. Lilies; virtually all varieties of lilies can lead to kidney failure.
6. Liquid potpourri; cats may lick this or clean it off their paws after stepping in it.
7. Nonsteroidal anti-inflammatory drugs, including ibuprofen and aspirin.
8. Acetaminophen (Tylenol); even one tablet can be fatal.
9. Anticoagulant rodenticides; cats may eat these or may eat rodents who have the poison in their system.
10. Amphetamines; even very small amounts are serious.

General Treatment of Poisoning

If your cat ingests an unknown substance, it is important to determine whether that substance is a poison. Most products have labels that list their ingredients, but if the label doesn't tell you the composition and toxicity of the product, call the ASPCA Animal Poison Control Center at (888) 426-4435 for specific information. The Poison Control Center has a staff of licensed veterinarians and board-certified toxicologists on call 24 hours a day, every day of the year. You will be charged a consultation fee of $50 per case, which can be charged to most major credit cards. There is no charge for follow-up calls in critical cases. At your request, the center will also contact your veterinarian. You can also log onto www.aspca.org and click on "Animal Poison Control Center" for more information, including a list of toxic and nontoxic plants.

Other poison control hotlines include the Angell Animal Poison Control Hotline, operated by Angell Animal Medical Centers and the Massachusetts SPCA (877-226-4355, www.smspca.org) and the Animal Poison Hotline, operated by the North Shore Animal League and PROSAR International Animal Poison Center at (888) 232-8870.

In some cases, you can call the emergency room at your local hospital, which may be able to give you information about how to treat the poison. Specific antidotes are available for some poisons, but they cannot be administered unless the poison is known, or at least suspected by the circumstances. Some product labels have phone numbers you can call for safety information about their products.

When signs of poisoning develop, the most important consideration is to get your cat to the nearest emergency veterinary facility at once. If possible, find the poison and bring the container with you. This provides the emergency personnel with an immediate diagnosis and expedites treatment.

If the cat has ingested the substance recently, residual poison is often present in his stomach. An initial and most important step is to rid the cat's stomach of any remaining poison. The most effective way to empty the stomach is to pass a stomach tube, remove as much of the stomach contents as possible, and then wash the stomach out with large volumes of water. This must be done by your veterinarian.

In many cases, it is preferable to induce vomiting at the scene rather than proceed directly to the veterinary hospital. For example, if you see the cat swallow the poisonous substance, it is obviously best to make the cat vomit it right back up. Similarly, if the poison was ingested within two hours but it will take 30 minutes or longer to get to a veterinary facility, it is frequently advisable to induce vomiting at home. However,

DO NOT induce vomiting

- If the cat has already vomited
- If the cat is in a stupor, breathing with difficulty, or shows any sign of neurological involvement

- If the cat is unconscious or convulsing
- If the cat has swallowed an acid, alkali, cleaning solution, household chemical, or petroleum product
- If the cat has swallowed a sharp object that could lodge in the esophagus or perforate the stomach
- If the label on the product says, "Do not induce vomiting"

How to Induce Vomiting and Prevent Poison Absorption

Induce vomiting by giving the cat hydrogen peroxide. A 3 percent solution is most effective. Give 1 teaspoon (5 ml) hydrogen peroxide per 10 pounds (4.53 kg) body weight of the cat, with a limit of 3 teaspoons. If the cat doesn't vomit after the first dose, you may repeat every 10 minutes, up to three times, until the cat vomits. If possible, get your cat to walk around or shake him gently in your arms after giving the hydrogen peroxide. This often helps stimulate vomiting.

Once the poison has been cleared from the cat's stomach, give him activated charcoal to bind any remaining poison and prevent further absorption. The most effective and easily administered home oral charcoal product is compressed activated charcoal, which comes in 5-gram tablets (recommended for the home emergency medical kit, see page 1). The dose is one tablet per 10 pounds (4.5 kg) of body weight. Products that come in a liquid, or as a powder made into a slurry, are extremely difficult to administer at home with a syringe or medicine bottle. The slurry is dense and gooey, and few cats will swallow it voluntarily. (A few cats will eat the slurry mixed with food.) These products are best administered by stomach tube. This is routinely done by your veterinarian after flushing out the stomach.

If activated charcoal is not available, coat the intestines with milk and egg whites using ¼ cup (60 ml) egg whites and ¼ cup milk. Mix this and give the cat about 2 teaspoons (10 ml) by mouth. Administer into the cat's cheek pouch using a plastic syringe (see *How to Give Medications*, page 554), or add to food. If you use the syringe, drip the mixture in because you don't want the cat to aspirate it into his lungs, which can lead to aspiration pneumonia.

Intensive care in a veterinary hospital improves the survival rate for cats who have been poisoned. Intravenous fluids support circulation, treat shock, and protect the kidneys. A large urine output assists in eliminating the poison. Corticosteroids may be given for their anti-inflammatory effects. A cat in a coma may benefit from tracheal intubation and artificial ventilation during the acute phase of respiratory depression.

A cat who is beginning to show signs of nervous system involvement is in deep trouble. *Get your cat to a veterinarian as quickly as possible*. Try to bring a sample of vomitus or, better yet, the actual poison in the original container. Do not delay administering first aid. If the cat is convulsing, unconscious, or not breathing, administer CPR (page 12).

Seizures

Seizures caused by poisons are associated with prolonged periods of hypoxia and the potential for brain damage. Continuous or recurrent seizures are controlled with intravenous diazepam (Valium) or barbiturates, which must be administered by a veterinarian.

Seizures caused by strychnine and other central nervous system poisons may be mistaken for epilepsy. This could be a problem, because immediate veterinary attention is needed in cases of poisoning, but not for most epileptic seizures. Seizures caused by poisoning usually are continuous or recur within minutes. Between seizures the cat may exhibit tremors, lack of coordination, weakness, abdominal pain, and diarrhea. In contrast, most epileptic seizures are brief, seldom lasting more than two minutes, and are followed by a quiet period in which the cat appears dazed but otherwise normal.

See *Seizures* (page 339) for seizure care. Cats cannot swallow their tongues, so don't try to pull the tongue out while the cat is having a seizure or you risk a serious bite. Wrapping the cat in a towel or blanket may help keep him quiet and out of harm during the seizure.

Contact Poisons

If your cat has a poisonous substance on his skin or coat, flush the area with large amounts of lukewarm water for 30 minutes. Wearing gloves, give the cat a complete bath in *lukewarm,* not cold, water, as described on page 124. Even if the substance is not irritating the skin, it must be removed. Otherwise, the cat will likely lick it off and swallow it. Soak gasoline and oil stains with mineral or vegetable oil (do not use paint thinner or turpentine). Work in well. Then wash the cat with a mild soap. Rub in cornstarch or flour to absorb any residual oils, then brush it out.

DRUG POISONING

Unintentional overdose with veterinary medications and accidental ingestion of both human and veterinary pills are a common cause of poisoning in all pets. Veterinary products, in particular, are often flavored to encourage a pet to take them, and will be eagerly consumed if they are discovered. Curious cats are often attracted to dropped or rolling pills and may chase and try to eat them.

Many people give over-the-counter medications to their cats, without veterinary approval, to treat a variety of symptoms; they believe that what works for people works for cats. Unfortunately, this is not true. Cats are unusually sensitive to many medications. Drugs given to cats in human dosages are almost always toxic—and some human drugs cannot be given to cats in any amount.

Common pain relievers such as ibuprofen (Advil) and acetaminophen (Tylenol) are very toxic to cats. Cats do not have the necessary enzymes to

detoxify and eliminate these drugs. Specifically, they are lacking the liver enzyme glucuronyl transferase. This enzyme breaks down drugs so they can be metabolized. Without it, ingesting certain drugs can lead to the accumulation of dangerous substances in the animal that are left behind when the drugs are metabolized. Symptoms develop quickly and include abdominal pain, salivation, vomiting, and weakness.

Other human drugs that produce a variety of toxic effects and are commonly involved in accidental poisonings include antidepressants, antihistamines, nonsteroidal pain relievers, sleeping pills, diet pills, heart pills, blood pressure pills, and vitamins.

Treatment: All instances of drug ingestion should be taken seriously. If you suspect your pet has swallowed any drug, immediately induce vomiting and coat the bowel as described on page 29. Call your veterinarian for further instructions. A specific antidote may be available for the drug in question. Also call a poison control center (see page 28).

Prevention: All medications should be safely stored in childproof containers and in closed cupboards. Always consult your veterinarian before administering any medication. Follow instructions exactly for frequency and dosage. *Never assume that a human drug is safe for pets!*

ANTIFREEZE

Poisoning by antifreeze that contains ethylene glycol is one of the most common small animal toxicities. Exposure typically occurs when antifreeze drips from the car radiator and is lapped up by the cat.

The poison primarily affects the brain and the kidneys. Signs of toxicity are dose-related, and occur within 30 minutes and up to 12 hours after ingestion. They include depression, vomiting, an uncoordinated "drunken" gait, and seizures. Coma and death can occur in a matter of hours. Cats who recover from acute intoxication frequently develop kidney failure one to three days later. Death is common.

Treatment: If you see or suspect that your pet has ingested even a small amount of antifreeze, immediately induce vomiting (see page 29) and take your cat to the veterinarian. If treatment will be delayed, administer activated charcoal (see page 29) to prevent further absorption of ethylene glycol. Cats should be placed on IV fluids and given ethanol therapy to prevent the metabolism of ethylene glycol. Intensive care in an animal hospital may prevent kidney failure. Some veterinary referral centers may offer dialysis as part of the cat's treatment.

Prevention: This common cause of pet and child poisoning can be prevented by keeping all antifreeze containers tightly closed and properly stored, preventing spills, and properly disposing of used antifreeze. A new generation of antifreeze products contains propylene glycol rather than ethylene glycol.

The U.S. Food and Drug Administration has labeled propylene glycol as "generally recognized as safe," which means it can be added to foods. However, that is in small amounts and only for people. Cats should not consume this either. Ingesting propylene glycol antifreeze can cause lack of coordination and, possibly, seizures, but is unlikely to be fatal.

RODENT POISONS

Common rat and mouse poisons include anticoagulants and hypercalcemic agents. Both can be deadly if your cat ingests them and, in some cases, if he eats a rodent who has these poisons in its system.

Anticoagulants

Anticoagulant rat and mouse poisons are the most commonly used household poisons. These products account for a large number of accidental poisonings in cats and dogs. Anticoagulants block the synthesis of vitamin K-dependent coagulation factors, which are essential for normal blood clotting.

Observable signs of poisoning do not occur until several days after ingestion. The cat may become weak and pale from blood loss, have nosebleeds, vomit blood, have rectal bleeding, develop *hematomas* and bruises beneath the skin, or have hemorrhages beneath the gums. The cat may be found dead from bleeding into the chest or abdomen.

There are two generations of anticoagulants, both in current use. The first-generation anticoagulants are cumulative poisons that require multiple feedings over several days to kill the rodent. These poisons contain the anticoagulants warfarin and hydroxycoumarin.

Second-generation anticoagulants contain bromadiolone and brodifacoum, poisons that are 50 to 200 times more toxic than warfarin and hydroxycoumarin. These products are more dangerous to pets and are capable of killing rodents after a single feeding. It is possible for a cat to be poisoned by eating a dead rodent with residual poison in its stomach.

Closely related to the second-generation anticoagulants are the long-acting anticoagulants of the indanedione class (pindone, diphacinone, diphenadione, and chlorphacinone), which are extremely toxic.

Treatment: Seek immediate veterinary help. If at all possible, bring in the product container so the veterinarian can identify the poison. This is important, because treatment depends on whether the poison was a first- or second-generation anticoagulant. With observed or suspected recent ingestion, induce vomiting (see page 29).

Treatment of spontaneous bleeding caused by all anticoagulants involves your veterinarian administering fresh whole blood or frozen plasma in amounts determined by the rate and volume of blood loss. Vitamin K_1 is a specific antidote. It is given by subcutaneous injection and repeated subcutaneously or

orally as necessary until clotting time returns to normal. With first-generation anticoagulants, this often occurs within a week. With long-acting anticoagulants, treatment takes up to a month because of the length of time the poison remains in the cat's system.

Hypercalcemic Agents

Hypercalcemic agents are poisons that contain vitamin D (cholecalciferol) as their effective agent. Cholecalciferol poisons work by raising the calcium content in blood serum to toxic levels, eventually producing cardiac arrhythmias and death. They are becoming increasingly popular because rodents do not develop resistance to them. Cats who eat poisoned rodents may develop toxicity, but in most cases, the cat must eat the poison itself to become ill.

In cats, signs of hypercalcemia appear 18 to 36 hours after ingesting the poison. The signs include thirst and frequent urination, vomiting, generalized weakness, muscle twitching, seizures, and, finally, death. Among survivors, the effects of an elevated serum calcium may persist for weeks.

Treatment: If you suspect your cat has ingested one of these poisons within the past four hours, induce vomiting (see page 29) and notify your veterinarian. Veterinary treatment involves correcting the fluid and electrolyte imbalances and lowering calcium levels using diuretics, prednisone, oral phosphorus binders, and a low-calcium prescription diet. Calcitonin is a specific antidote, but it is difficult to obtain and has only short-term effects.

Bromethalin

This rodenticide acts on the central nervous system by causing *edema* in the cells of the brain and spinal cord. One of the first signs seen in cats is paralysis, including seizures or inability to urinate. Mild cases may show only *ataxia*.

Treatment: If caught soon after ingestion, induce vomiting (see page 29) and follow up with activated charcoal (page 29). Get the cat to your veterinarian. Steroids given by your veterinarian and gingko supplements may help, at least somewhat. Once symptoms have started it can be dangerous to give any oral treatments. If the cat survives, recovery may take weeks.

POISON BAITS

Animal baits containing strychnine, sodium fluoroacetate, phosphorus, zinc phosphide, and metaldehyde are used in rural areas to control gophers, coyotes, and other predators. They are also used in stables and barns to eliminate rodents. These baits are highly palatable and therefore may be ingested by a cat. Many are extremely toxic and kill in a matter of minutes. Fortunately, they are being used less frequently because of livestock losses, concerns about persistence in the environment, and their potential to poison pets and children.

Strychnine

Strychnine is used as a rat, mouse, and mole poison. It has also been a common coyote bait. Fortunately, the use of strychnine is decreasing. In concentrations greater than 0.5 percent, its use is restricted to certified exterminators. It is available to the public in concentrations of 0.3 percent or less. With better regulation and the use of lower concentrations, strychnine is becoming a less common cause of accidental poisoning.

It is available commercially as coated pellets dyed purple, red, or green. Signs of poisoning are so typical that the diagnosis can be made almost at once. Onset is sudden (less than two hours after ingestion). The first signs are agitation, excitability, and apprehension. They are followed rather quickly by intensely painful muscular seizures that last about 60 seconds, during which the cat throws his head back, can't breathe, and turns blue. The slightest stimulation, such as tapping the cat or clapping your hands, starts a seizure. This characteristic response is used to make the diagnosis. Other signs associated with nervous system involvement include tremors, champing, drooling, uncoordinated muscle spasms, collapse, and paddling the legs.

Seizures due to strychnine and other central nervous system toxins are sometimes misdiagnosed as epilepsy. This error can be a fatal mistake, because immediate veterinary attention is necessary to treat poisoning. Epileptic seizures usually last a few minutes and do not recur during the same episode. Signs always appear in a certain order, and each attack is the same. They are over before the cat can get to a veterinarian. Usually, they are not considered emergencies (see *Seizures*, page 339).

Treatment: If your cat is showing the first signs of poisoning and hasn't vomited, induce vomiting as discussed on page 29. Do not induce vomiting if the cat exhibits signs of labored breathing or has started having seizures.

With signs of central nervous system involvement, do not delay to induce vomiting. It is important to avoid loud noises or unnecessary handling that might trigger a seizure. Cover your cat with a coat or blanket and immediately go to the nearest veterinary clinic. Further treatment involves your veterinarian administering intravenous diazepam (Valium) or barbiturates to control seizures. The cat is then placed in a dark, quiet room and disturbed as little as possible.

Sodium Fluoroacetate

Sodium fluoroacetate (compound 1080/1081), a very potent rat and gopher poison, is mixed with cereal, bran, and other rodent feeds. It is so potent that cats and dogs can be poisoned just by eating a dead rodent. Its use is restricted to licensed pest control operators and it is used infrequently in the United States, but it might be found in old barns.

The onset of signs is sudden and begins with vomiting, followed by agitation, straining to urinate or defecate, a staggering gait, atypical fits or true convulsions, and then collapse. Seizures are not triggered by external stimuli, as are those of strychnine poisoning.

Treatment: Immediately after the cat ingests the poison, induce vomiting (see page 29). Care and handling is the same as for strychnine poisoning (page 34).

Arsenic

Arsenic has been combined with metaldehyde in slug and snail baits and may appear in ant poisons, weed killers, wood preservatives, and insecticides. Its use is on the decline. Arsenic is also a common impurity found in many chemicals. Death can occur quickly after ingestion, before there is time to observe the symptoms. In more protracted cases the signs include thirst, drooling, vomiting, staggering, intense abdominal pain, cramps, diarrhea, paralysis, and death. The breath of the cat will have a strong odor of garlic.

Treatment: Induce vomiting (see page 29). Go to your veterinarian to start intravenous fluid therapy to flush the kidneys. A chelating agent to bind the arsenic, called dimercaprol, may be used, but it has side effects. British anti-Lewisite (BAL) is a specific antidote.

Metaldehyde

This poison, often combined with arsenic, is used commonly in rat, snail, and slug baits. It may also be a component of solid fuel for camp stoves. The signs of toxicity are excitation, drooling and slobbering, uncoordinated gait, muscle tremors, and weakness that leads to inability to stand within a few hours after ingestion. The tremors are not triggered by external stimuli.

Treatment: Immediately after the cat ingests the poison, induce vomiting (see page 29). The care and handling are similar as described for strychnine poisoning (page 34). Death may occur days later from liver failure.

Phosphorus

This chemical is present in rat and roach poisons, fireworks, flares, matches, and matchboxes. A poisoned cat may have a garlic odor to his breath. The first signs of intoxication are vomiting and diarrhea. They may be followed by a symptom-free interval, then by recurrent vomiting, cramps, pain in the abdomen, convulsions, and coma.

Treatment: Induce vomiting (see page 29) when you suspect the cat has ingested a product or poison that contains phosphorus. Do not coat the bowel with milk or egg whites, as this can actually promote absorption. Take your cat to the nearest veterinary facility. There is no specific antidote.

Zinc Phosphide

This substance is found in rat poisons and grain fumigant. Intoxication causes central nervous system depression, labored breathing, vomiting (often with blood), weakness, convulsions, and death. Cats who eat rodents or birds poisoned by zinc phosphide may show signs of toxicity.

Treatment: There is no specific antidote. Treat as you would for strychnine poisoning (see page 34). A stomach *lavage* must be done at a veterinary clinic. The stomach should be lavaged with 5 percent sodium bicarbonate, which raises the gastric pH and delays the formation of gas.

INSECTICIDES

There are dozens of products sold at hardware, home repair, and agricultural stores to kill ants, termites, wasps, garden pests, and other insects. Most of them contain organophosphates and carbamates as their active ingredients. With the development of pyrethrin insecticides that are equally effective but much less toxic, organophosphates and carbamates are being used less frequently.

Organophosphates and Carbamates

The organophosphates include chlorpyrifos, diazinon, phosmet, fenthion cythioate, and tetrachlorvinphos. The two most common carbamates in pet products are carbaryl and propoxur. Most cases of organophosphate or carbamate poisoning occur because the cat ingested a poison bait or was treated with flea products made for dogs. Exposure to high concentrations of chemicals in sprays and dusts is also possible. Organophosphates are especially toxic to cats.

Signs of toxicity include hyperexcitability, excessive salivation and drooling, frequent urination, diarrhea, muscle twitching, weakness, staggering, collapse, and coma. Death is by respiratory failure.

Treatment: If you suspect your cat has ingested an insecticide poison, immediately induce vomiting (see page 29) and notify your veterinarian. With any sign of toxicity, the first priority is to get your cat to the veterinarian as quickly as possible.

The specific antidote your veterinarian will administer for organophosphate poisoning (*not* carbamate poisoning) is 2-PAM (pralidoxime chloride). Atropine is given for both organophosphate and carbamate poisoning to control excessive salivation, vomiting, frequent urination and defecation, and to reverse a slow heart rate. Seizures are controlled with diazepam (Valium) or barbiturates.

In the event of skin exposure, give the cat a bath with soapy water and rinse thoroughly to remove residual insecticide.

Chlorinated Hydrocarbons

These compounds, of which the prototype is DDT, are added to sprays and dusts to control plant pests. Their use has been curtailed because of persistent toxicity in the environment. Only lindane and methoxychlor are currently approved for use around livestock. Chlorinated hydrocarbons are readily inhaled and easily absorbed through the skin. Toxicity can occur from repeated exposure or a single excessive exposure. These compounds are extremely toxic to cats.

Signs of toxicity appear rapidly. The signs include hyperexcitability with twitching of the face, followed by muscle tremors that begin at the head and progress back to involve the neck, shoulder, trunk, and rear legs. Seizures and convulsions are followed by respiratory paralysis and death.

Treatment: There is no specific antidote. The cat should be thoroughly bathed. Treatment at a veterinary hospital includes supporting life functions, removing ingested poison from the stomach by gastric lavage and/or activated charcoal, and controlling seizures.

Pyrethrins and Pyrethroids

These compounds are incorporated into many insecticidal shampoos, sprays, dusts, dips, foggers, and sprays. Pyrethrins and the synthetic pyrethroids are much safer to use on and around dogs (and humans) than are other insecticides, and they are being used more widely. However, *only* the pyrethrins are safe for cats. In addition, many over-the-counter topical flea products have concentrated pyrethrins as their active ingredient. Cats may be affected by that high level of pyrethrins.

The synthetic pyrethroids are *not* safe for use in cats. Common chemicals in this class include permethrin, allethrin, fenvalerate, resmethrin, and sumethrin. Some cats have been poisoned by simply curling up and sleeping with a dog who has one of the topical permethrin products on him or by licking or grooming a dog with those products on his coat.

Signs of toxicity include drooling, depression, muscle tremors, staggering, vomiting, and rapid, labored breathing. Simultaneous exposure to organophosphates increases the toxicity of pyrethroids. Hyperthermia (high body temperature) may be noted.

Treatment: Induce vomiting (see page 29) within two hours of ingestion. Call your veterinarian for further instructions. Do not induce vomiting if the product contains a petroleum distillate. With signs of toxicity, proceed immediately to the veterinary clinic.

For topical exposure, remove residual insecticide by bathing the cat in *lukewarm* water (bathing in hot or cold water may actually increase the rate of absorption or cause hypothermia, which increases toxicity) and Dawn dishwashing soap or feline shampoo to strip out the chemicals. (*Do not* use flea shampoo.) Rinse very thoroughly. After bathing, keep the cat warm.

If signs of hyperthermia are evident, you must attempt to cool the cat down (see *Heat Stroke*, page 24). This is more common with permethrin toxicity.

Methocarbamol may be administered by your veterinarian to control tremors; diazepam is not usually effective. Fluid therapy is recommended to thoroughly flush the kidneys.

Prevention: Most cases of poisoning occur because flea control products are not applied properly. Follow all instructions carefully. *Only use products approved for cats on cats. Never use a product made for dogs on a cat.*

PETROLEUM PRODUCTS

Gasoline, kerosene, turpentine, and similar volatile liquids can cause pneumonia if they are aspirated (enter the lungs) or inhaled. The signs of toxicity include vomiting, difficulty breathing, tremors, convulsions, and coma. Death is by respiratory failure. Ingesting these compounds will cause gastrointestinal upset and may burn the mouth and esophagus, and may cause liver or kidney failure.

Treatment: *Do not induce vomiting.* Flush the mouth thoroughly to remove any traces of residue. Be prepared to administer artificial respiration (see page 11). Activated charcoal may be recommended by your veterinarian, or stomach lavage may be used to remove as much as possible of the ingested products.

These products can be very irritating to the skin, so remove them as quickly as possible. Bathe the cat using warm, soapy water. For tar in the coat, see page 127.

LEAD

Lead is found in insecticides and previously served as a base for many commercial paints. Intoxication occurs mainly in kittens and young cats who chew on substances that have been coated with a lead paint. Other sources of lead are linoleum, fishing weights, batteries, and plumbing materials. Lead poisoning can occur in older cats if they ingest an insecticide containing lead. A chronic form does occur with repeated low-level exposure.

Acute poisoning begins with abdominal pain and vomiting. In the chronic form, a variety of central nervous system signs are possible. They include fits, uncoordinated gait, excitation, attacks of hysteria, weakness, stupor, and blindness. These are also signs of encephalitis (see page 334).

Treatment: Immediately after ingestion, induce vomiting. Seek immediate medical attention. Specific antidotes are available from your veterinarian, who can also do blood tests to determine the lead levels.

CORROSIVE HOUSEHOLD PRODUCTS

Corrosive and caustic chemicals (acids and alkalis) are found in household cleaners, dishwasher detergents, toilet bowl cleaners, drain decloggers, and commercial solvents. When ingested, they cause burns of the mouth, esophagus, and stomach. Severe cases are associated with acute perforation of the esophagus and stomach. Later, strictures of these organs may develop from tissue damage and scarring. Even simply walking through a phenolic disinfectant solution, such as Lysol, can be dangerous for cats, especially if they lick their feet to clean them.

Treatment: *Do not induce vomiting!* Vomiting will simply double the tissue damage. Rinse out your cat's mouth—under a running faucet, if possible, or with a hose. Contact your veterinarian following any exposures to these products.

The practice of giving an acid to neutralize an alkali, and vice versa, is no longer recommended because it causes heat injury to the lining of the stomach.

If these products get on the cat's skin, prevent him from licking or grooming and flush the area thoroughly for at least 10 to 30 minutes with running water.

GARBAGE AND FOOD POISONS

Cats are more particular than dogs about what they eat. Nevertheless, they do sometimes scavenge and come into contact with carrion (rotting flesh or meat), decomposing foods, animal manure, and other noxious substances (some of which are listed in *Diarrhea*, page 228). Cats are more sensitive than dogs to food poisoning and exhibit effects at lower levels of exposure. This is partly due to their smaller size and the lack of the liver enzyme glucuronyl transferase.

Signs of poisoning usually begin with vomiting and pain in the abdomen. In severe cases, they are followed two to six hours later by a diarrhea that is often bloody. Shock may occur—particularly if the problem is complicated by bacterial infection. Mild cases recover in one to two days.

Treatment: *Seek immediate veterinary attention* for signs of dehydration, toxicity, and shock. In mild cases, coat the bowel as described in *How to Induce Vomiting and Prevent Poison Absorption* (page 29).

Dangerous Foods

Along with food poisoning from spoiled foods, cats lack the enzymes to properly digest some foods. Two of these are onions and garlic. Cats can be exposed to onion from the onion powder in some baby foods or by chewing on *Allium* species plants. Garlic may be a component of some natural flea repellant products. Signs are intestinal upset and possibly anemia as toxins build up

that destroy red blood cells. Treatment may include antioxidants, oxygen therapy, and even blood transfusions for severe cases.

Chocolate and coffee can be toxic to cats, due to the stimulants they contain—theobromine and caffeine, respectively. Signs include excitability, weakness, rapid breathing, and even death. Induce vomiting (see page 29). Activated charcoal (see page 29) may also be helpful. The cat may need fluid therapy at a veterinary clinic to flush the system.

Grapes, raisins, and macadamia nuts are all foods that have been found to be toxic in dogs. It can be assumed they are not good for cats, although luckily, cats seem to avoid these products. Xylitol, an artificial sweetener found in sugar-free baked goods and gums, is another food that is toxic to dogs and can be assumed to be toxic in cats.

POISONOUS PLANTS

With some types of vegetation, only certain parts of the plant are toxic. With others, the whole plant is poisonous. Ingestion causes a wide range of symptoms. They include mouth irritation, drooling, vomiting, diarrhea, hallucinations, seizures, coma, and death. Other plant substances cause skin rash. Some toxic plants have specific pharmacological actions, and are used in making medicines. The signs they cause vary widely.

Tables of toxic plants, shrubs, and trees are included on pages 41 to 43 for reference. This list is a collection of common toxic plants. It is not a list of all poisonous plants. If you're not sure about a plant, ask your veterinarian or the local plant nursery. The ASPCA also has a list of poisonous plants on its web site (www.aspca.org). Your local Cooperative Extension is often a good source of information about poisonous plants.

TOAD AND SALAMANDER POISONING

In North America there are two species of poisonous toad (*Bufo*). The Colorado River toad is found in the Southwest and Hawaii. The marine toad is found in Florida. There is one species of poisonous salamander, the California newt, found in California.

All toads, even nontoxic ones, have a bad taste. Cats who mouth them slobber, spit, and drool. The marine toad is highly poisonous, causing death in as little as 15 minutes.

Symptoms in cats depend on the toxicity of the toad or salamander and the amount of poison absorbed. They vary from slobbering to convulsions, blindness, and death.

Treatment: Flush out your cat's mouth (use a garden hose if necessary) and induce vomiting, as described on page 29. Be prepared to administer CPR (see page 12). Take your cat to the veterinarian. Be prepared to describe the toad or salamander in as much detail as you can. Cats with salamander poisoning usually recover quickly.

Indoor Plants with Toxic Effects

Houseplants that cause a skin reaction after contact with the skin or mouth

Chrysanthemum	Poinsettia
Creeping fig	Weeping fig

Irritating plants, some of which contain oxalic acid, which causes mouth swelling, difficulty swallowing, respiratory problems, and gastrointestinal upsets

Arrowhead vine	Marble queen
Boston ivy	Mother-in-law plant
Caladium	Neththyis
Calla or arum lily	Parlor ivy
Dumbcane (dieffenbachia)	Pothos or devil's lily
Elephant's ear	Peace lily
Emerald duke	Red princess
Heart leaf (philodendron)	Saddle leaf (philodendron)
Jack-in-the-pulpit	Split leaf (philodendron)
Majesty	Tuberous begonia
Malanga	

Plants that contain a wide variety of poisons—most cause vomiting, an acutely painful abdomen, and cramps; some cause tremors, heart and respiratory problems, and/or kidney problems, which are difficult for owners to interpret

Amaryllis	Jerusalem cherry
Asparagus fern	Nightshade
Azalea	Pot mum
Bird-of-paradise	Ripple ivy
Creeping Charlie	Spider mum
Crown of thorns	Sprengeri fern
Elephant's ear	Umbrella plant
Ivy species	

continued

Outdoor Plants with Toxic Effects

Outdoor plants that can cause vomiting and diarrhea

Bittersweet woody	Indian tobacco
Castor bean	Indian turnip
Crocus	Larkspur woody
Daffodil	Poke weed
Delphinium	Skunk cabbage
Foxglove	Soapberry
Ground cherry	Tulip
Hyacinth	Wisteria

Trees and shrubs that may cause vomiting, painful abdomen, and diarrhea

American yew	Horse chestnut
Apricot	Japanese plum
Almond	Mock orange
Azalea (rhododendron)	Monkey pod
Balsam pear	Peach
Bird-of-paradise bush	Privet
Buckeye	Rain tree
Cherry	Western black locust yew
English holly	Wild cherry
English yew	

Outdoor plants with varied toxic effects

Angel's trumpet	Mescal bean
Buttercup	Moonseed
Day lily	Mushrooms
Dologeton	Nightshades
Dutchman's breeches	Pigweed
Jasmine	Poison hemlock
Jimsonweed	Rhubarb
Locoweed	Spinach
Lupine	Sunburned potatoes

Outdoor Plants with Toxic Effects	
May apple	Tomato vine
Matrimony vine	Water hemlock
Tiger lily	
Hallucinogens	
Locoweed	Periwinkle
Marijuana	Peyote
Morning glory	Poppies
Nutmeg	
Outdoor plants that cause convulsions	
Chinaberry	Nux vomica
Coriaria	Water hemlock
Moonweed	

Insect Stings, Spiders, and Scorpions

Because cats are predators and are curious by nature, they tend to be at risk from small poisonous creatures. The stings of bees, wasps, yellow jackets, and ants cause painful swelling at the site of the sting. Cats tend to get stung about the face and on the paws. Swelling may include the face and neck, or be localized to the area of the sting. If a cat is stung many times, he could go into shock as the result of absorbed toxins. Rarely, a hypersensitivity reaction (anaphylactic shock) can occur if the cat was exposed in the past (see page 13).

The stings of black widow and brown recluse spiders and tarantulas are toxic to animals. The first sign is sharp pain at the sting site. Later, the cat may develop excitability, chills, fever, and labored breathing. Shock and seizures may occur, with early paralysis from black widow bites. Most cats will die. There is antivenin if it can be obtained from your veterinarian in time. Brown recluse spider bites cause two syndromes. One is a cutaneous form with a localized blister and pain. Eventually, a bull's-eye lesion may be noted. Over a week or two, the involved skin will die and ulcerate, leaving a wound that may take months to heal. The second, visceral form is accompanied by fever, painful joints, and possibly vomiting and seizures. Cats may develop blood disorders and kidney failure. This form is much rarer and is often fatal.

Tarantula bites are usually not serious, but the barbed hairs they drop can be irritating to skin and mucous membranes.

The stings of centipedes and scorpions cause a local reaction and, at times, severe illness. These bites heal slowly. Poisonous scorpions are found only in southern Arizona (two species). A young kitten or small cat is at greater risk due to his small size.

TREATING STINGS AND BITES

1. Identify the insect or animal, if possible.
2. Remove an embedded stinger with tweezers, or scrape it out with a credit card. (Only bees leave their stingers behind.)
3. Make a paste of baking soda and apply it directly to the sting.
4. Apply ice packs to relieve swelling and pain.
5. Apply Calamine lotion and Cortaid to relieve itching if needed, but cover the area with a loose bandage so the cat will not lick off the medication.

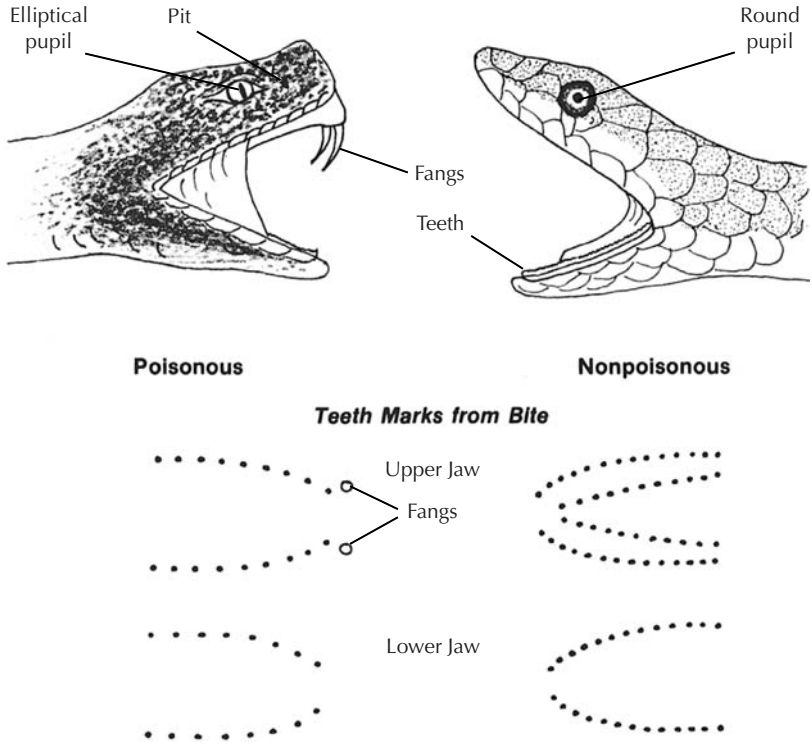
If the cat exhibits signs of generalized toxicity or anaphylaxis (restlessness, agitation, face scratching, drooling, vomiting, diarrhea, difficulty breathing, collapse, or seizures), transport him immediately to the nearest veterinary facility. If your cat is known to have reactions to bee stings, ask your veterinarian about keeping an EpiPen kit available and what dose to use for your cat. The EpiPen kits are special prepackaged kits of injectable epinephrine for counteracting anaphylactic shock. Epinephrine has a short expiration date, so check frequently to be sure your kit is not outdated.

Snake and Lizard Bites

Poisonous and nonpoisonous snakes are widely distributed throughout North America. Cats may come into contact with snakes while hunting or out of curiosity. In general, bites of nonpoisonous snakes do not cause swelling or pain. They show teeth marks in the shape of a horseshoe (no fang marks).

Ninety percent of snake bites in cats involve the head and legs. Body bites from poisonous snakes usually are lethal.

In the United States there are four poisonous varieties: cottonmouths (also called water moccasins), rattlesnakes, copperheads, and coral snakes. The diagnosis of poison snake bite is made by the appearance of the bite, the behavior of the animal bitten, and identification of the species of snake. (Kill it first, if possible.)



Except for the coral snake, all poisonous species in North America are pit vipers. Note the elliptical pupil, the pit below the eye, the large fangs, and the characteristic bite.

PIT VIPERS (RATTLESNAKES, COTTONMOUTHS, AND COPPERHEADS)

You can identify these species by their large size (4 to 8 feet, 1.2 to 2.4 m long), triangular heads, pits below and between the eyes, elliptical pupils, rough scales, and the presence of retractable fangs in the upper jaw.

The bite: You may see one or two bleeding puncture wounds in the skin; these are fang marks. You may have to search the haircoat and skin carefully at first to find the punctures. Signs of local reaction appear quickly and include sudden severe swelling, redness, and hemorrhages in the skin. The pain is immediate and severe.

Note that 25 percent of poisonous snake bites lack venom and thus do not produce a local reaction. While absence of local swelling and pain is a good sign, it does not guarantee the cat won't become sick. Severe venom poisoning has been known to occur without a local reaction.

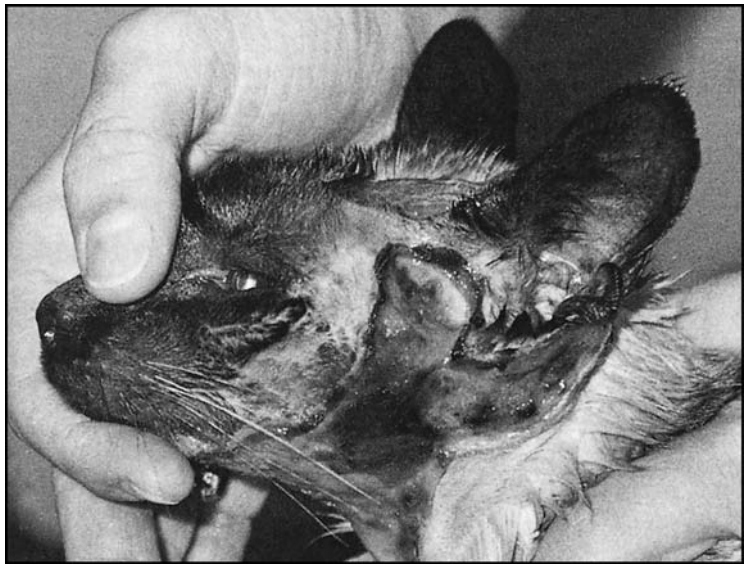
The cat's behavior: Signs of envenomation may take several hours to appear because of variables such as time of the year, species of the snake, toxicity of the venom, amount injected, location of the bite, and size and health of the cat. The amount of venom injected bears no relationship to the size of the snake. The first signs are extreme restlessness, panting, drooling, and weakness. These are followed by diarrhea, depressed breathing, collapse, sometimes seizures, shock, and death in severe cases.

CORAL SNAKES

Identify this snake by its rather small size (less than 3 feet, .9 m long), small head with black nose, and brightly colored alternating bands (red, yellow and black) fully encircling the body. The fangs in the upper jaw are not retractable.

The bite: There is less severe redness and swelling at the site of the bite, but the pain may range from mild to excruciating, depending on whether venom was injected. Look for the fang marks.

The cat's behavior: Coral snake venom is a neurotoxin, meaning it affects the nerves and causes weakness and paralysis. Signs include vomiting, diarrhea, urinary incontinence, paralysis, convulsions, and coma. Some cats will survive.



This cat with a poisonous snake bite shows an extensive face wound after loss of devitalized tissue.

LIZARDS

Two species of poisonous lizard are found in the United States, both in southwestern states. They are the Gila monster and the Mexican bearded lizard. The bite of these lizards could potentially be fatal to a cat. If the lizard has a firm hold on the cat, pry open the lizard's jaws with pliers and remove the cat from the lizard.

TREATING SNAKE AND LIZARD BITES

First identify the snake or lizard and look at the bite. If the animal is not poisonous, clean and dress the wound as described in the section on *Wounds* (below). If it appears the cat has been bitten by a poisonous snake or lizard and if you are within 30 minutes of a veterinary hospital, *proceed at once to the veterinary hospital*. If you are unable to get help within 30 minutes, follow these steps, then go to the nearest veterinarian.

- *Keep the cat quiet*. Venom spreads rapidly if the cat is active. Excitement, exercise, and struggling increase the rate of absorption. Carry the cat.
- If the bite is on the leg, apply a constricting bandage (a handkerchief or a strip of cloth) between the bite and the cat's heart. You should be able to get a finger beneath the bandage; loosen the bandage for five minutes every hour.
- Do not wash the wound, because this will increase venom absorption.
- Do not apply ice, because this does not slow absorption and can damage tissue.
- Do not make cuts over the wound and/or attempt to suck out the venom. This is never successful and you could absorb venom.

Proceed to the veterinary hospital. Veterinary treatment involves respiratory and circulatory support, antihistamines, intravenous fluids, and species-specific antivenin. The earlier the antivenin is given, the better the results. Because signs of envenomation are often delayed, all cats who have been bitten by a poisonous snake or lizard—even those who don't show signs—should be hospitalized and observed for 24 hours.

Wounds

The two most important goals in treating wounds are to stop the bleeding and to prevent infection. Wounds are painful, so be prepared to restrain the cat before treating the wound (see *Handling and Restraint*, page 2).

CONTROLLING BLEEDING

Bleeding may be arterial (bright red blood will spurt out) or venous (dark red blood will ooze out), or sometimes both. Do not wipe a wound that has stopped bleeding, as this will dislodge the clot. Similarly, don't pour hydrogen peroxide on a fresh wound. Peroxide dissolves clots and starts a fresh round of bleeding. It may also damage the tissues and delay healing.

The two methods used to control bleeding in an emergency situation are a pressure dressing and a tourniquet.

Pressure Dressing

The most effective and safest method for controlling bleeding is to apply pressure directly to the wound. Take several sterile gauze squares (or, in an emergency, use any clean cloth such as a thickly folded pad of clothing) and place it over the wound. Apply direct pressure for 5 to 10 minutes. Leave the dressing in place and bandage snugly. If material for bandaging is not available, hold the pack in place until help arrives.

Watch for signs of swelling of the limb below the pressure pack (see *Foot and Leg Bandages,* page 52). This indicates impaired circulation. If you see these signs, the bandage must be loosened or removed. Consider adding more bulk to the pack and apply a second bandage over the first. Transport the cat to a veterinary hospital.

Tourniquet

Tourniquets can be used on the extremities and tail to control arterial bleeding that can't be controlled with a pressure pack. *Tourniquets should never be used if bleeding can be controlled by direct pressure.* Always place the tourniquet *above* the wound (between the wound and the heart).

A suitable tourniquet can be made from a piece of cloth, belt, or length of gauze. Loop the tourniquet around the limb, then tighten it by hand or with a stick inserted beneath the loop. Twist the loop until the bleeding stops.

If you see the end of the artery, you might attempt to pick it up with a pair of tweezers and tie it off with a piece of cotton thread. When possible, this should be left to a trained practitioner.

A tourniquet should be loosened every 10 minutes to prevent tissue hypoxia and to check for persistent bleeding. If bleeding has stopped, apply a pressure bandage as described in the previous section. If bleeding continues, let the blood flow for 30 seconds and then retighten the tourniquet for another 10 minutes.

PUNCTURE WOUNDS

Puncture wounds are caused by bites and pointed objects. Animal bites, in particular, are heavily contaminated with bacteria. There may be bleeding. There may also be bruising, particularly if the cat was picked up in the teeth of a bigger animal and shaken. Puncture wounds are often concealed by the cat's coat and may easily be overlooked until an abscess develops a few days later.

Treating a puncture wound requires a veterinarian. It involves surgically enlarging the skin opening to provide drainage, after which the area is irrigated with a dilute antiseptic surgical solution. These wounds should not be closed. With all animal bites, keep in mind the possibility of rabies. If your cat is bitten by an animal of unknown vaccination status or a wild animal, a rabies booster may be recommended.

Bites from other cats very often lead to abscesses. Antibiotics are frequently prescribed for bite wounds and wounds that are heavily contaminated, such as puncture wounds.

TREATING WOUNDS

Nearly all animal wounds are contaminated with dirt and bacteria. Proper care and handling will reduce the risk of tetanus and prevent many infections. Before handling a wound, make sure your hands and instruments are clean.

An infected wound near the base of the tail from a cat fight. Because of the bacteria in cats' mouths, bites from other cats often lead to infection and abscess.

The five steps in wound care are as follows:

1. Skin preparation
2. Wound irrigation
3. Debridement
4. Wound closure
5. Bandaging

Skin Preparation

Remove the original pressure dressing and cleanse the area around the wound with a surgical scrub solution. The most commonly used solutions are Betadine (povidone-iodine) and Nolvasan (chlorhexidine diacetate). Both products are extremely irritating to exposed tissue in the concentrations provided in the stock solutions (Betadine 10 percent, chlorhexidine 2 percent), so be very careful that the solution does not get in the wound while scrubbing the skin around it. Dilute the solution to a weak tea color for Betadine or a pale blue color for Nolvasan.

After the scrub, start at the edges of the wound and clip the cat's coat back far enough to prevent any long hairs from getting into the wound.

Three-percent hydrogen peroxide, often recommended as a wound cleanser, has little value as an antiseptic and is extremely toxic to tissues. Do not use it on a wound, as it can damage tissues and delay healing.

Wound Irrigation

The purpose of irrigation is to remove dirt and bacteria. The gentlest and most effective method of wound cleansing is by *lavage*, which involves irrigating the wound with large amounts of fluid until the tissues are clean and glistening. Do not vigorously cleanse the wound using a brush or gauze pad because this causes bleeding and traumatizes the exposed tissue.

Tap water is an acceptable and convenient irrigating solution. Tap water has a negligible bacterial count and is known to cause less tissue reaction than sterile or distilled water.

If possible, add chlorhexidine solution or Betadine solution to the tap water for antibacterial activity. Chlorhexidine has the greater residual antiseptic effect, but either antiseptic solution (not soap solutions) is satisfactory when correctly diluted. To dilute chlorhexidine, add 25 ml of the 2 percent stock solution to 2 quarts (2 l) of water, making a 0.05 percent irrigating solution. To dilute Betadine, add 10 ml of the 10 percent stock solution to 2 quarts (2 l) of water to make a 0.2 percent irrigating solution.

The effectiveness of the irrigation is related to the volume and pressure of the fluid used. A bulb syringe is a low-pressure system. It is least effective and

requires more fluid to achieve satisfactory irrigation. A large plastic syringe removes a moderate amount of dirt and bacteria. A home Waterpik unit (used by people to clean their teeth) or a commercial lavage unit that provides a high-pressure stream of fluid is the most effective.

A garden hose with a pressure nozzle for the initial lavage, or a kitchen sink spray unit, followed by one of the methods just described to deliver the antiseptic, is a good alternative. You want to flush and clean the wound, not force dirt deeper into the tissues. Angle your flow of liquid to accomplish that and let the fluid pool to bring debris to the surface.

Debridement

Debridement means removing dying tissue and any remaining foreign matter using tissue forceps (tweezers) and scissors or a scalpel. Debridement requires experience to determine the difference between normal and devitalized tissue, and instruments to control bleeding and close the wound. Accordingly, wounds that require debridement and closure should be treated by a veterinarian.

Wound Closure

Fresh lacerations on the lips, face, eyelids, and ears are best sutured or stapled to prevent infection, minimize scarring, and speed recovery. Lacerations longer than half an inch (1.25 cm) on the body and extremities probably should be closed, but small lacerations may not need to be. The exception is small V-shaped lacerations, which almost always heal best if sutured.

Wounds contaminated by dirt and debris are quite likely to become infected if they are closed at the time of injury. These wounds should be left open or sutured around a drain that can be used for through and through irrigation. Similarly, wounds older than 12 hours should not be closed without drainage. Suturing or stapling should be avoided if the wound appears to be infected (is red, swollen, or has a surface discharge).

Your veterinarian may decide to close a wound that has been left open for several days and has developed a bed of clean tissue. Wounds that are clean after several days are resistant to infection and usually can be closed without negative consequences. Suturing such a wound is called delayed primary closure.

The length of time sutures or staples should remain in place depends on the wound's location and other characteristics. Most sutures and staples can be removed after 10 to 14 days.

Bandaging

Bandaging protects the wound from dirt and contaminants. It also restricts movement, compresses skin flaps, eliminates pockets of serum, keeps the edges of the wound from pulling apart, and prevents the cat from biting and licking at the wound. Bandaging is most effective for wounds to the extremities. Dressings

over draining or infected wounds must be changed once or twice a day. The bandage should be bulky enough to absorb the drainage without soaking through.

Bandages are more difficult to apply to cats than to dogs and, once applied, are more difficult to keep in place. Cats who do not tolerate bandages and continually remove them may be helped by mild sedation. As an alternative, an Elizabethan collar or a BiteNot collar may be helpful. Wounds about the head and those draining pus are best left open to help drainage and ease of treatment.

When a cat claws and macerates a wound or continually scratches at a skin condition, treatment can be facilitated by bandaging his back feet or securing baby socks over the paws, and clipping his nails.

Bandaging is made much easier when a cat is gently but firmly restrained, as discussed on page 2. The bandaging equipment you will need is listed in the *Home Emergency and Medical Kit* (page 1).

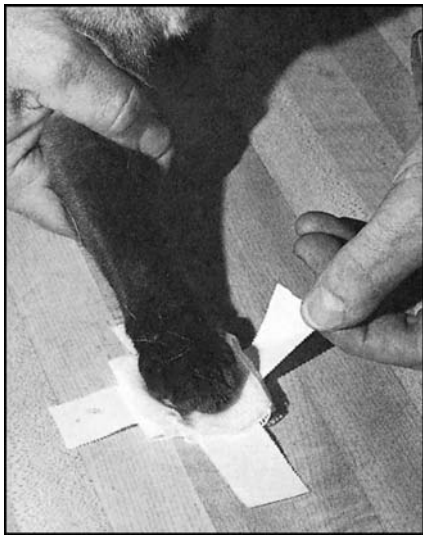
Foot and Leg Bandages

To bandage a foot, place several sterile gauze pads over the wound. Pull apart a cotton ball and insert small bits between the cat's toes. Hold in place with adhesive tape looped around the bottom of the foot and back across the top until the foot is snugly wrapped.

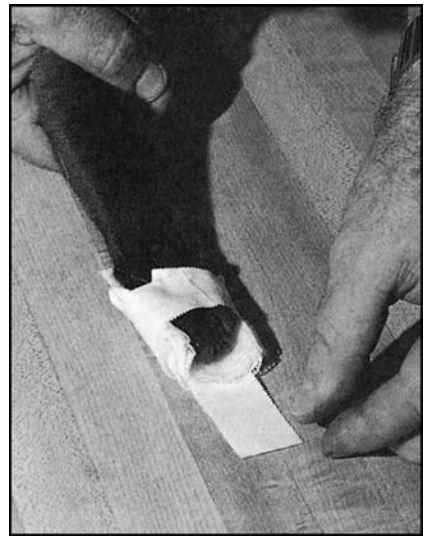
For leg wounds, begin by wrapping the foot as just described. Then cover the wound with several sterile gauze pads and hold in place with strips of adhesive tape. On top, pad the entire leg with plenty of cotton so the dressing won't become too tight and interfere with circulation. Wrap the leg first with roll gauze, firmly but not too tightly, then wrap the leg with elastic tape or bandage, as shown in the photographs on page 53. Your veterinarian or a veterinary technician can show you the best way to bandage an individual wound.

Veterinary wraps, such as VetWrap, work well, but you need practice to have the right amount of tension so you don't cut off circulation. Flex the knee and foot several times to be sure the bandage is not too tight and that there is good movement at the joints.

Wrap the tape around the leg at the top, but do not overlap it because you want the tape to stick to the cat's hair. This technique keeps the dressing from sliding up and down, which often happens when only a roll gauze bandage is used without tape at the top. When a dressing is to be left in place for some time, check every few hours to be sure the foot is not swelling. Over the next few hours, check the toes for coolness and observe the feet for swelling. Swelling of the leg below a bandage will be seen in the toes. When the toes are swollen, the nails are spread apart instead of being side by side. If this swelling is not treated by removing the bandage, the foot becomes cold and loses feeling. If there is any question about the sensation or circulation to the



To apply a foot bandage, start by covering the injured area with several layers of gauze.



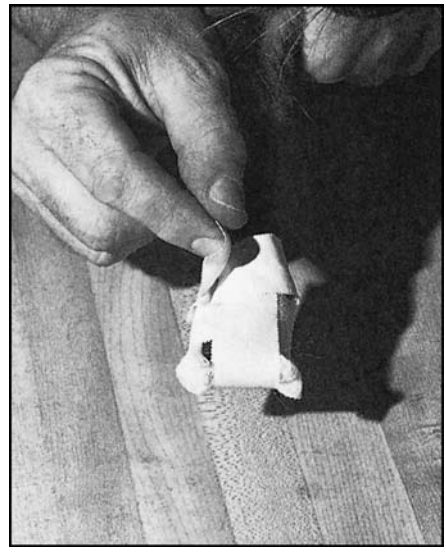
Hold the gauze in place with adhesive tape looped around the bottom of the foot and back across the top.

foot, loosen the dressing. Cats will frequently attempt to lick, bite or remove dressings that are too tight and uncomfortable.

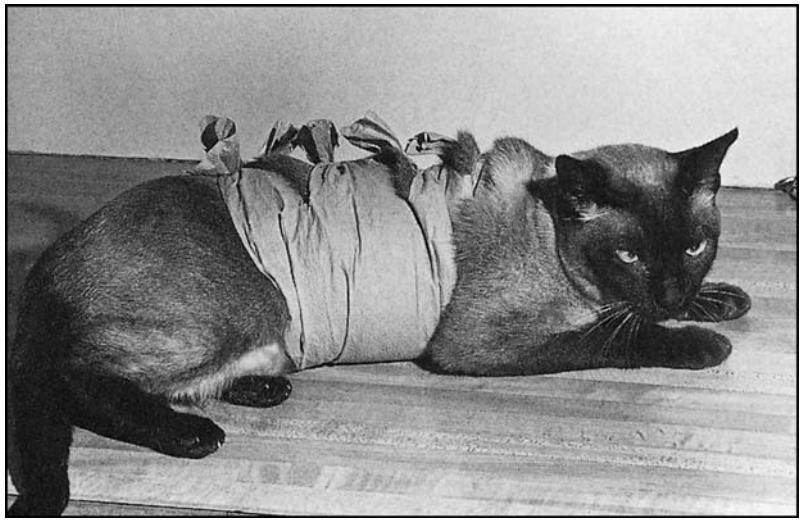
You may need to put a plastic baggie over the wound bandage when the cat goes to the litter box, to prevent litter from getting up inside the bandage. A cat with a bandage should not be allowed outside.

Bandages over clean, healing wounds can be changed every two days, but should be inspected three or four times a day for signs of constriction, limb swelling, slippage, drainage, or soiling. If there are signs of any of these problems, replace the bandage.

Wounds on the foot or leg may be covered with a splint as well as a bandage. The splint minimizes movement of the area and speeds healing.



Tape loosely to allow for good circulation.



A many-tailed bandage may be used to keep kittens from nursing if the mother's breasts are infected.

Many-Tailed Bandage

This bandage is used to protect the skin of the abdomen, flanks, or back from scratching and biting and to hold dressings in place. It is made by taking a rectangular piece of linen and cutting the sides to make tails. Tie the tails together over the back to hold the bandage in place.

Ear Bandage

These dressings are difficult to apply. Most ear injuries can be left open. To protect the ears from scratching, use an Elizabethan or a BiteNot collar.

Eye Bandage

Your veterinarian may prescribe an eye bandage as part of the treatment of an eye ailment. Place a sterile gauze square over the affected eye and hold it in place by taping around the head with 1-inch-wide (25-mm) adhesive. Be careful not to wind the tape too tight. Apply the dressing so that the ears are free.

You may need to change the dressing from time to time to apply medication to the eye. Many cats will need to wear an Elizabethan or a BiteNot collar to prevent them from removing the bandage.

To make an eye bandage, wrap a gauze roll around the eye. A pad may be placed beneath the gauze. Secure with tape. The ears should be free.

HOME WOUND CARE

Small, open wounds can be treated at home without sutures or staples. Medicate the area twice a day with a topical antibiotic ointment such as triple antibiotic. The wound can be left open or covered with a dressing. Make sure the cat is not licking or chewing at the wound. You may need to use a wound covering such as a sock, or put an Elizabethan or a BiteNot collar on the cat.

Infected wounds that are draining pus require the application of moist sterile compresses. A number of topical antiseptics are effective in treating superficial wound infections. They include chlorhexidine, Betadine (diluted as described in *Wound Irrigation*, page 50), Furacin (both the topical cream and the 0.2 percent solution), 1 percent Silvadene cream, and topical antibiotics containing bacitracin, neomycin, and polymyxin B (triple antibiotic). Apply the topical antibiotic directly to the wound or place it on a gauze pad and dab the wound.

Change the dressing once or twice a day to facilitate pus drainage. Again, try to keep the cat from licking or grooming off the medication. Distracting the cat with play or food may give the medication time to be absorbed.

2

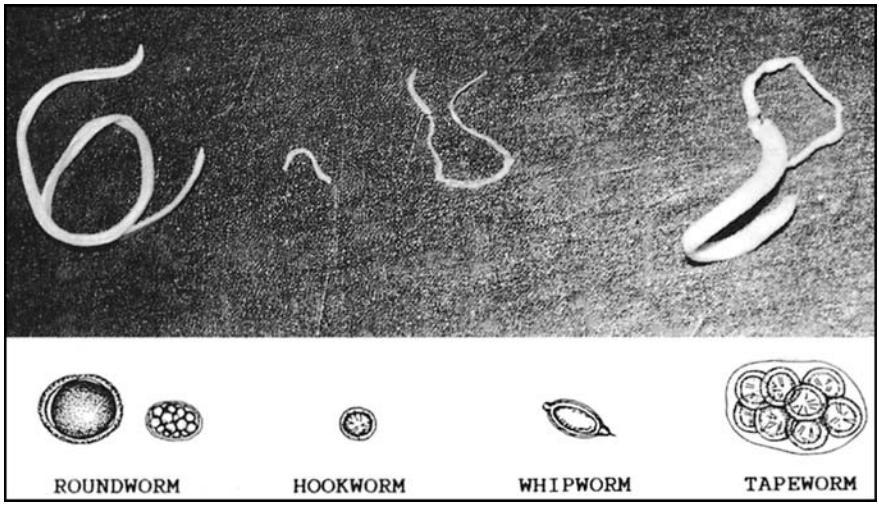
GASTROINTESTINAL PARASITES

Most cats will suffer from internal parasites at some time in their lives. Kittens can be infected through nursing. Cats who go outside, especially if they hunt, are also prone to picking up parasites. Even cats who live completely indoors may be exposed from a new cat joining the family or by catching a mouse that snuck into the house. Mosquitoes and fleas inside your home can also carry parasites.

The ideal parasite lives in its host without causing serious health problems. However, once parasite populations reach a certain size, clinical signs of illness become evident in the animal in which they live. If worms are causing a problem, there is often some change in the appearance of the cat's stool, which may include the passage of mucus or blood. There is also a decline in the cat's general health. You may note decreased appetite, loss of weight, sometimes protrusion of the third eyelid, diarrhea, and anemia.

Ascarids (roundworms), tapeworms, and hookworms are the most common intestinal parasites in cats. Healthy adult cats develop a certain degree of immunity to parasites, which helps keep any populations down. This varies with the individual parasite, though. For example, some parasites, such as tapeworms, return time after time. It is probable that cats, like dogs, develop a resistance to certain intestinal parasites whose larvae migrate in the animal's tissues (such as ascarids and hookworms), although this has not been proven in cats. Tapeworms have no migratory phase and thus cause little buildup of immunity.

Resistance to ascarids also appears to be age-related. Kittens and young cats show less resistance and, in consequence, may experience a heavy infestation. This can lead to marked debility or even death. Cats over 6 months of age are less likely to show significant clinical signs.



Common adult feline worms, showing the relative size and appearance of adult worms and eggs. (There are two species of roundworm eggs.)

Immunosuppressive drugs, such as cortisone and some chemotherapy drugs, have been shown to activate large numbers of hookworm larvae lying dormant in an animal's tissues. Stressful events, such as trauma, surgery, severe disease, or emotional upsets, can also activate dormant larvae. This leads to the appearance of eggs in the stool.

During lactation, dormant ascarid larvae are activated and appear in the queen's milk. Therefore, a heavy parasite problem might develop in the litter even when the mother was effectively dewormed. This can happen because none of the deworming agents are completely effective against larvae that are encysted in the tissue.

Deworming Your Cat

Although some deworming medications are effective against more than one species of worms, there is no medication that is effective against them all. Accordingly, for a medication to be safe and effective, a precise diagnosis is required. It is also important that the medication be given precisely as directed. Natural side effects, such as diarrhea and vomiting, must be distinguished from toxic reactions. All dewormers are poisons—ideally, they are more poisonous to the parasites than they are to the hosts. For these reasons, it is advisable to deworm your cat *only* under veterinary supervision.

DEWORMING KITTENS

A very large proportion of kittens are infested with ascarids. Other worms may be present, too. It is advisable to have your veterinarian check your kitten's stool before treating her for ascarids. Otherwise, other worms and internal parasites, such as coccidia, may go undetected.

Worm infestations are particularly harmful in kittens who are subjected to overfeeding, chilling, close confinement, or a sudden change in diet. Stressful conditions such as these should be corrected before administering a deworming agent. Do not deworm a kitten with diarrhea or other signs of illness, unless your veterinarian has determined that the illness is caused by an intestinal parasite.

Kittens with ascarids should be dewormed at 2 to 3 weeks of age and again at 5 to 6 weeks (see *Ascarids*, page 60). If eggs or worms are still found in the stool, subsequent treatment should be given. Due to public health considerations, many veterinarians recommend deworming kittens with a safe dewormer every month until 6 months of age.

DEWORMING ADULT CATS

Most veterinarians recommend that adult cats be dewormed only when there is specific evidence of an infestation. A microscopic stool examination is the most effective way of making an exact diagnosis and choosing the best deworming agent.

It is not advisable to deworm a cat who is suffering from some unexplained illness that is assumed to be caused by worms. *All dewormers are poison*—meant to poison the worm, but not the cat. Cats who are debilitated by another disease may be too weak to resist the toxic effects of the deworming agent.

Cats of all ages, particularly those who hunt and roam freely, can be subject to periodic heavy worm infestations. These cats should be checked once or twice a year. If parasites are identified, they should be treated. It is reasonable to deworm outdoor cats routinely for ascarids and tapeworms, even without a positive stool sample. Many anthelmintics are safe for repeated use. Tapeworms segments may be seen frequently, and when discovered, they should be treated. Cats with tapeworms may need to be treated as often as four or five times a year.

A queen should have her stool checked before breeding. If parasites are found, she should receive a thorough deworming. This will not protect her kittens from all worm infestations, but it will decrease the frequency and severity of any parasite infestation. It will also help to put her in the best condition for a healthy pregnancy.

Common Deworming Medications

Medication	Ascarids	Hookworms	Tapeworms	Comments
Epsiprantel	No effect	No effect	Good	
Fenbendazole	Good	Good	Good	Also treats giardia
Ivermectin	Fair	Good	No effect	Also prevents heartworm
Milbemycin oxime	Good	Good	No effect	Also prevents heartworm
Piperazine	Good	No effect	No effect	
Praziquantal	No effect	No effect	Good	
Praziquantel with pyrantel	Good	Good	Good	
Pyrantel pamoate	Good	Good	No effect	
Selamectin	Good	Good	No effect	Also prevents heartworm

HOW TO CONTROL WORMS

The life cycles of most worms are such that the possibility of reinfestation is great. To keep worms under control, you must destroy the eggs or larvae *before* they reinfest the cat. This means good sanitation and maintaining clean, dry quarters for your cat. It also means controlling intermediate hosts, such as fleas and rodents.

Cats should be kept as indoor pets, but some cats may live or go outside and others may have safe enclosures that are outside. For outside enclosures, cats should not be crowded together on shaded earth, which provides ideal conditions for seeding eggs and larvae. A watertight flooring surface, such as cement, is the easiest to keep clean. Hose it down daily and allow it to dry in the sun. Concrete surfaces can be disinfected with lime, salt, or borax (1 ounce per 10 square feet; 2 ml per .9 sq m). Remove stools from the cat pens daily. Lawns should be cut short and watered only when necessary. Stools elsewhere in the yard should be removed at least twice a week.

Fleas, lice, cockroaches, beetles, waterbugs, and rodents are intermediate hosts of tapeworms or ascarids. It is necessary to get rid of these pests to control reinfestation, as described in *Eliminating Fleas on the Premises* (page 139).

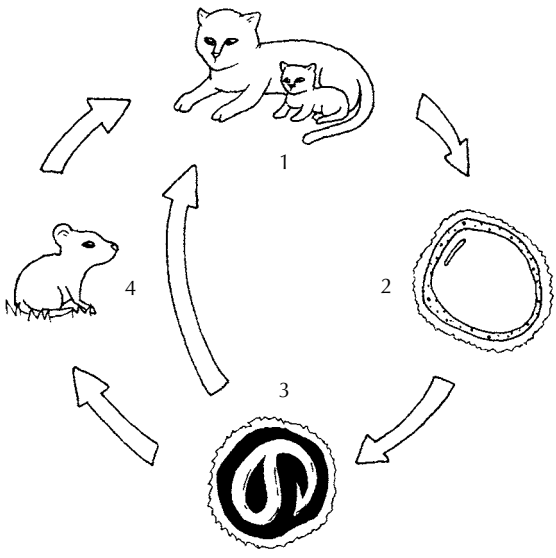
Stool and wet areas should be removed daily from the litter box. The litter box should be kept clean and dry and should be washed frequently with a solution of bleach and boiling water. Rinse thoroughly and dry completely before refilling with litter.

Many internal parasites spend the early stages of their life cycle in another animal and can only infect the cat and develop into adults when the cat preys on and eats this other animal. Accordingly, cats should not be allowed to roam and hunt. Be sure to thoroughly cook all fresh meat before feeding it to your cat.

Catteries that have continuous problems with worms often have other problems, too. These problems include skin, bowel, and respiratory difficulties. Steps should be taken to improve the management of the cattery, especially sanitation measures.

Ascarids (Roundworms)

Ascarids are the most common worm parasite in cats, occurring in a large percentage of kittens and in 25 to 75 percent of adults. There are two common species that infest the cat. Adult ascarids live in the stomach and intestines and can grow to 5 inches (13 cm) long. The eggs are protected by a hard shell. They are extremely hardy and can live for months or years in the soil. They become infective in three to four weeks after being passed out in stool.



Life cycle of *Toxocara cati*

The cat passes eggs in her stool or larvae in her milk (1). The larvae infect her nursing kitten. Eggs from the stool (2) develop into larvae (3) and are eaten by rodents (4). The cat then eats the rodents while hunting. If the larvae pass through the kitten before maturing, the mother cat can also reinfest herself while grooming her kittens.

Cats acquire the disease by ingesting the eggs, perhaps through contact with soil containing the eggs, by them licking off their feet, or by eating a host animal, such as a beetle or rodent, which has acquired encysted larvae in its tissues. The larvae are then released in the cat's digestive tract.

Larvae of the common feline ascarid *Toxocara cati* are capable of migrating in tissues. Eggs, entering orally, hatch in the intestines. Larvae are carried to the lungs by the bloodstream. There, they become mobile and crawl up the trachea where they are then swallowed. This may cause bouts of coughing and gagging. They return to the intestines and develop into adults. This version of migration is most common in kittens.

In adult cats, only a few larvae return to the intestines. The others encyst in tissues and remain dormant. During lactation, these dormant larvae are released, reenter the circulation, and are transmitted to kittens in the mother's milk. When the queen is shedding larvae in her milk, she may not pass any eggs in her stool. Therefore, it makes sense to deworm both mother and kittens starting about 3 weeks of age, even if a fecal exam is negative.

Deworming the queen before or during pregnancy does not prevent all ascarid infestation of kittens after birth, but it will decrease the frequency and severity. Medications do not eliminate encysted larvae.

The second most common feline ascarid is *Toxascaris leonina*. This ascarid is not passed via the milk into nursing kittens but can be acquired by ingesting the eggs or by eating infected rodents.

Ascarids usually do not produce a heavy infestation in adult cats, but may do so among cats who do a lot of hunting. In kittens, a heavy infestation can result in severe illness or even death. Such kittens appear thin and have a pot-bellied look. They sometimes cough or vomit, have diarrhea, are anemic, and may develop pneumonia as the worms migrate from the blood vessels to the air sacs of the lungs. Worms may be found in the vomitus or the stool. Typically, they look like white earthworms or strands of spaghetti that are alive and moving.

Treatment: Pyrantel pamoate is a safe, effective choice and can be used in nursing kittens. Kittens should be dewormed by 3 weeks of age to prevent contamination of their quarters by ascarid eggs. A second course should be given two to three weeks later to kill any adult worms that were in the larval stage at the first deworming. Subsequent courses are indicated if eggs or worms are found in the stool. Many veterinarians suggest deworming kittens monthly until 6 months of age.

Pyrantel pamoate dewormers can be obtained from your veterinarian. You do not have to fast your cat before using this medication. Be sure to follow the directions of the manufacturer about dosage. Milbemycin, ivermectin, and selamectin are also very effective dewormers, but they are generally used in older kittens and adult cats.

Public health considerations: Ascarids can cause a disease in humans called visceral larva migrans. This is considered to be a serious public health

problem and is one of the top *zoonotic* diseases. Most cases are caused by the canine ascarid, *Toxocara canis*, but *Toxocara cati* also can produce this disease. Some cases are reported each year, usually from areas with a mild climate. Children are most frequently affected, and often have a history of eating dirt. Outdoor sandboxes should be covered when not in use to prevent cats from using them as litter boxes, and gloves should be worn when gardening.

When a human eats an ascarid egg, larvae develop as in the cat. However, because humans are not a definitive host, the larvae do not progress to adult ascarids. Instead, they migrate in the tissues and wander aimlessly, causing fever, anemia, liver enlargement, pneumonia, and other ill effects. In children, the migrating larvae may enter the eye, leading to a disease called ocular larva migrans and potentially causing the loss of that eye. The disease runs its course in about a year. It is best prevented by controlling infestation in dogs and cats through periodic deworming and good sanitation.

Hookworms

Hookworms are small, thin worms about ¼ to ½ inches (.6 to 1.3 cm) long. They fasten to the wall of the small intestines and draw blood from the host. There are four species of hookworms that afflict the cat. Hookworms are not as common in cats as they are in dogs. They are most prevalent in areas that have high temperature and humidity (for example, in the southern United States), where conditions are favorable for the rapid development and spread of larvae.

A cat acquires the disease by ingesting infected larvae in soil or feces or by direct penetration of the skin (usually the pads of the feet). In rare cases, a cat may acquire the parasite by eating mice that host the larvae. The immature worms migrate through the lungs to the intestines, where they become adults. In about two weeks, the cat begins to pass eggs in her feces. The eggs incubate in the soil. Depending on conditions, larvae can become infective within two to five days after being passed.

The typical signs of hookworm infestation are diarrhea, anemia, weight loss, and progressive weakness. With a heavy infestation, stools may be bloody, wine-dark or tarry-black, but this is uncommon. A hookworm infestation can be fatal in very young kittens. The diagnosis is made by finding the eggs in the feces.

Newborn kittens do not acquire the infection *in utero* but might via the milk of the queen. Chronic infestation is a more common problem in adult cats than it is in kittens.

Many cats who recover from the disease become carriers via cysts in the tissue. During periods of stress or some other illness, a new outbreak can occur as the larvae are released.

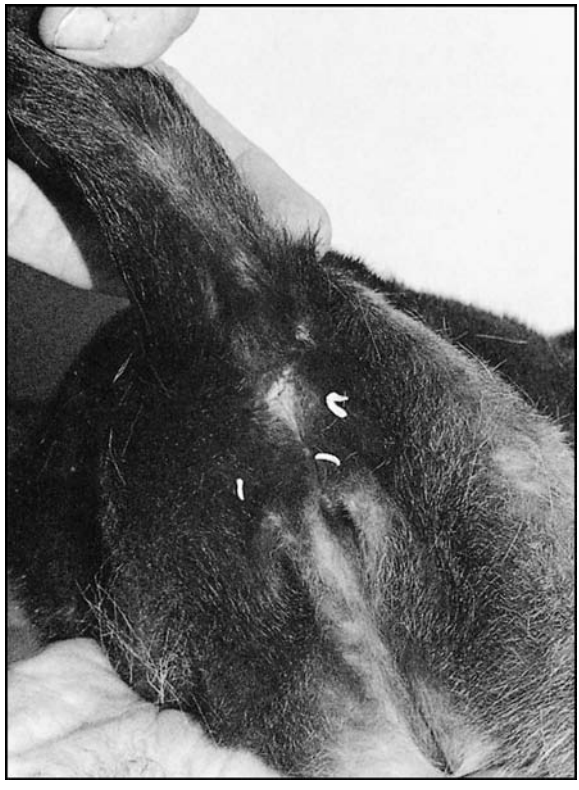
Treatment: Pyrantel pamoate and selamectin have become the deworming medications of choice because of their safety and effectiveness. Milbemycin and ivermectin are also very effective dewormers but are generally used only in older kittens and adult cats. Two treatments are given two weeks apart. The stool should be checked to determine the effectiveness of treatment.

Kittens with acute signs and symptoms require intensive veterinary management. To prevent reinfestation, see *How to Control Worms*, page 59.

Public health considerations: A disease in humans called cutaneous larvae migrans (creeping eruption) is caused by hookworm species. Larvae present in the soil penetrate the skin and travel through the body. It causes lumps, streaks beneath the skin, and itching. The condition is self-limiting.

Tapeworms

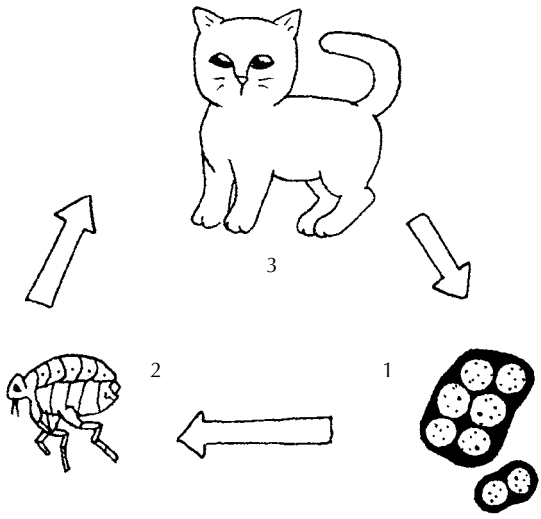
Tapeworms are the most common internal parasite in adult cats. They live in the small intestines, and vary in length from less than 1 inch (25 mm) to several feet (1 foot is .3 meters). The scolex (head) of the parasite fastens itself to the wall of the gut using hooks and suckers. The body is composed of segments that contain egg packets. To eliminate tapeworm infection, the head must be destroyed. Otherwise, the worm will regenerate.



Tapeworm segments can sometimes be found crawling in the fur around the anus of an infested cat.

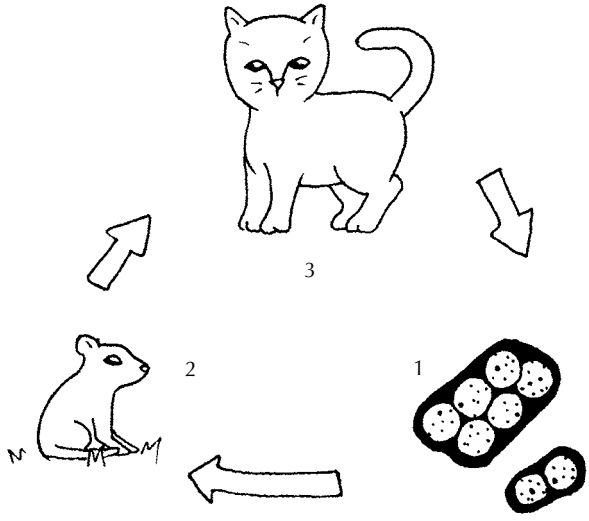
The body segments containing the eggs are passed in the feces. These are called proglottids. Fresh moist segments are capable of moving. They are about .25 inches (6.3 mm) long. Occasionally, you might see them in the fur about your cat's anus or in her stool. When dry, they resemble grains of rice.

There are two common tapeworm species found in cats; both are



Segments pass in the stool and around the cat's rectum (1). The segments or individual egg packets are eaten by fleas (2). The cat then ingests fleas while grooming (3).

Life cycle of *Dipylidium caninum*



Segments pass in the stool and around the cat's rectum (1). The segments or individual egg packets are eaten by rodents (2). The cat then ingests the rodent while hunting (3).

Life cycle of *Taenia taeniaeformis*

transmitted by an intermediate host. *Dipylidium caninum* is acquired from fleas or lice that harbor immature tapeworms in their intestines. These insects acquire the parasite by eating tapeworm eggs. The cat must bite or swallow the insect to become infested. The tapeworm *Taenia taeniaformis* is acquired by eating rodents, uncooked meat, raw freshwater fish, or discarded animal parts.

Dibothriocephalus latus and *Spirometra mansonoides* are two uncommon tapeworms cats might acquire from eating uncooked freshwater fish or a water snake. *Spirometra mansonoides* is seen primarily in outdoor cats along the Gulf Coast region. *Dibothriocephalus latus* might be seen in the Gulf Coast region or around the Great Lakes. *Echinococcus* tapeworms are rarely found in cats.

Treatment: Praziquantal is one of the most effective medications for both common species of cat tapeworm. Other suitable treatments are fenbendazole and espiprantal. Use under veterinary guidance. Deworming must be combined with control of fleas and lice (see *A Suggested Flea-control Program*, page 138), in the case of *Dipylidium caninum*, and by preventing roaming and hunting in the case of other tapeworms.

Public health considerations: A child could acquire a tapeworm if they accidentally swallowed an infected flea. Except for this unusual circumstance, cat tapeworms do not present a hazard to human health.

Other Worm Parasites

All the parasites in this section occur rarely in cats. Heartworms are discussed in chapter 11 (see page 326). Eye worms occur among cats living on the West Coast of the United States. They are discussed in chapter 5 (see page 192). Pinworms, which are a common cause of concern to families with children, are not acquired or spread by cats.

TRICHINOSIS

Trichinosis is acquired by ingesting uncooked pork that contains the encysted larvae of *Trichina spiralis*. It is estimated that 15 percent of the people living in the United States have, at some time, acquired trichinosis, although only a few clinical cases are reported each year. The incidence is probably somewhat higher in cats and dogs. Signs include muscle pain, headaches, and joint pain.

Prevent this disease by keeping your cat from roaming, particularly if you live in a rural area. Cook all fresh meat (your own *and* your cat's).

Treatment: This involves using the drug mebendazole, under the supervision of your veterinarian.

STRONGYLOIDES

There are two primary species of this parasite: *Strongyloides cati*, which is mainly found in subtropical climates and may be seen in the southern United States; and *Strongyloides stercoralis*, which is actually a human parasite but can

be passed to cats (and then back again.) These are not common parasites. Signs of infestation include diarrhea with blood and mucus.

Treatment: The treatment is ivermectin or thiabendazole.

WHIPWORMS

These are slender parasites, 2 to 3 inches (50 to 76 mm) long that live in the cecum (the first part of the large intestine). Since they are thicker at one end, they have the appearance of a whip. Whipworms are usually found incidentally and are not known to cause disease in cats.

Treatment: No treatment is necessary.

FLUKES

Flukes are flatworms ranging in size from a few millimeters up to an inch or more in length. There are several species that colonize different parts of the cat's body, including the lung, liver, and small intestines. Gastrointestinal flukes are acquired by eating infected raw fish and small prey such as snails, frogs, and crayfish. It is suspected that the fluke parasite *Alaria marcianae* could also be passed to kittens of infected queens through the mother's milk.

Signs of fluke infestation vary and are often minimal. Infection should be prevented by cooking fish and restricting your cat's hunting opportunities.

Treatment: Professional diagnosis and treatment are required. Drug treatment is difficult and is not always successful.

STOMACH WORMS

These parasites are most likely to affect cats living in the southwestern United States. There are primarily two species of stomach worms that affect cats. The infection is acquired by eating beetles, cockroaches, crickets, lizards, or hedgehogs that have ingested eggs from the soil, in the case of *Physaloptera praeputialis*, or by contact with vomitus from an infected cat in the case of *Ollulanus tricuspis*.

Recurrent vomiting is the most common sign. Veterinary diagnosis is necessary to distinguish stomach worms from other causes of vomiting and to determine the specific species causing the infection. Eggs are not usually found in the feces, but worms may be detected by gastric *lavage* or by checking the vomitus. Prevent this disease by keeping your cat from roaming and hunting.

Treatment: The most effective dewormers are tetramisole for *Ollulanus* species and ivermectin or levamisole for *Physlaoptera*.

Protozoal Parasites

Protozoa are single-celled animals that are not visible to the naked eye but are easily seen under a microscope. They are usually carried by and live in water. A fresh stool specimen is required to identify the adult parasite or its cysts (called oocysts), because these disease agents are not usually identified by the standard fecal flotation techniques.

GIARDIASIS

This disease is caused by a protozoan of the *Giardia* species. Cats have their own species-specific version of *Giardia*. Cats acquire the infection by drinking water from streams and other sources that are contaminated with infective cysts.

Most infections in adult cats are subclinical. Young cats and kittens can develop a diarrhea syndrome characterized by the passage of large volumes of foul-smelling, watery stools. The diarrhea maybe acute or chronic, intermittent or persistent, and may be accompanied by weight loss.

Diagnosis is made by finding the protozoan or its characteristics cysts in saline smears of fresh stool. Smears from rectal swabs are satisfactory. A negative smear does not exclude giardia, as cysts are shed only intermittently. Three negative fecal smears collected at least two days apart should be obtained before the diagnosis is excluded. Serology tests (*ELISA* and *IFA*) are now available.

Cats do not seem to develop an immunity to giardiasis, so prevention includes cleaning up areas of stagnant water where the protozoa may flourish and/or keeping cats away from those areas. The indoor environment should be thoroughly cleaned as well.

Treatment: Giardiasis responds well to Flagyl (metronidazole). Because Flagyl causes developmental malformations in the fetus, it should not be administered to pregnant queens. Metronidazole also prevents bacterial overgrowth and may influence existing immune disorders in the intestines. Other effective drugs are available, such as febendazole. There is now a vaccine available for giardiasis, but it is rarely recommended because the disease is usually mild and responds well to treatment.

TOXOPLASMOSIS

This disease is caused by the protozoan *Toxoplasma gondii*. Cats are likely to acquire the infection by consuming infected birds or rodents or, rarely, by ingesting oocysts in contaminated soil. Cats are the primary host for this obligate intracellular parasite (a parasite that can only exist inside the living cell of another organism), but it can infect other warm-blooded animals.

Evidence strongly suggests that cats (and people) can also get the disease from eating raw or undercooked pork, beef, mutton, or veal or unpasteurized dairy products that contains toxoplasma organisms. In cats, the oocysts develop in the intestines and are passed out in the feces, so the feces of infected cats present another source of infection. These infective oocysts are only passed for a very short time after initial exposure. Cats and humans can transmit toxoplasma *in utero* to their unborn offspring.

Feline intestinal toxoplasmosis is usually asymptomatic. When symptomatic, it affects the brain, spinal cord, eyes, lymphatic system, and lungs. The most common signs are loss of appetite, lethargy, cough, and rapid breathing. Visual and neurological signs may be evident. Other signs are fever, weight loss, diarrhea, and swelling of the abdomen. Lymph nodes may enlarge. Kittens may exhibit encephalitis, liver insufficiency, or pneumonia. Prenatal infection may be responsible for abortion, stillbirths, and unexplained perinatal deaths, including the fading kitten syndrome. Many cats that show clinical signs are concurrently infected with feline immunodeficiency virus (FIV) or feline leukemia virus (FeLV).

The finding of *T. gondii* oocysts in the cat's stool indicates the cat is currently infective to other cats and people. Serologic tests (including *ELISA*) will show whether a cat has ever been exposed. A positive test in a healthy cat signifies that the cat has acquired active immunity and is therefore not a source of human contamination.

To prevent this parasite, cats should not be fed raw meat or allowed to hunt. They also should not be given unpasteurized dairy products. If you have an indoor cat who eats only cat food, she's not likely to ever be infected.

Treatment: Antibiotics such as clindamycin are available to treat active infection and prevent the intestinal phase of oocyst shedding.

Public health considerations: About half the human adult population shows serological evidence of having been exposed in the past. Men and women with protective antibodies probably will be immune to infection. However, the disease is a particular hazard when a pregnant woman without prior immunity is exposed to it. Immunocompromised people are also at risk.

Toxoplasmosis infection in a pregnant woman can result in abortion, stillbirth, and birth of babies with central nervous system infection. Cats are the only animals who pass on the infectious stage of this parasite through their feces, and this has given rise to the incorrect assumption that pregnant women should not have cats. If you are pregnant, *it is not necessary to get rid of your cat!* The majority of human cases—by a wide margin—come from eating raw or undercooked meat, particularly lamb or pork. Unpastuerized dairy products can also be a source of infection. Wash fresh vegetables carefully, because oocysts can also cling to bits of soil. And wear gloves while gardening to avoid contact with infected soil.

It is important to understand the mode of transmission from cats to understand how minimal the risk is. Even a cat with an active toxoplasmosis infection is only capable of passing it on for seven to ten days *of her entire life*, when there's an acute infection. It takes anywhere from one to three days for oocysts shed in the feces to become infectious—which means the litter box would have to sit unscooped for one to three days before the infection could be passed on. Then, to become infected from cat feces, a person would have to touch the feces and then touch an opening in their body.

Pregnant women can be tested to determine if they have had prior exposure, in which case they have acquired immunity and there is no risk. They can also take precautions to avoid contact with fecal material from cats by wearing gloves when gardening and cleaning the litter box.

Prevent the disease in your cat by keeping the cat from roaming and hunting. Wear disposable plastic gloves when handling the cat's litter. Remove stools every day from the litter box. Dispose of the litter carefully so that others will not come into contact with it. Clean and disinfect litter boxes often using boiling water and a diluted bleach solution. Cover children's sandboxes when not in use to keep them from being used as a litter box by stray cats.

Cook all fresh meat, both yours and your cat's, maintaining a temperature of at least 150°F (65.5°C, medium well). Wash your hands with soap and water after handling raw meat. Clean all kitchen surfaces that have been in contact with raw meat.

COCCIDIOSIS

Coccidiosis usually targets young kittens shortly after weaning, although adult cats can be affected. The disease is highly contagious. Immunity following recovery from infection is short-lived. Cats who recover often become carriers and shed adult oocysts in their feces.

There are several species of coccidia. Only *Cystoisospora* (formerly known as *Isospora*) *felis* is directly transmitted by fecal contamination from cat to cat. Other species use birds and animals as intermediate transport hosts. These species complete their life cycle when the transport host is eaten by the cat. Kittens acquire Cystoisospora felis from mothers who are carriers.

Five to seven days after ingesting the oocysts, infective cysts appear in the feces. Much of the life cycle takes place in the cells lining the small intestines. Diarrhea is the most common sign of infection. The feces are mucuslike and tinged with blood. In severe cases, a bloody diarrhea may develop. These cases are complicated by weakness, dehydration, and anemia.

Coccidia can be found in the stools of kittens without causing problems, until some stress factor, such as overcrowding, malnutrition, weaning problems, an outbreak of ascarids, or shipping reduces their resistance. Normal fecal flotations will pick up these parasites.

Treatment: Offer a bland diet and encourage fluid intake. A severely dehydrated or anemic cat may need to be hospitalized for fluid replacement or blood transfusion. Kittens are more likely to require intensive care than adult cats.

Supportive treatment is important, since in most cases the acute phase of the illness lasts about ten days and the cat then recovers. Sulfonamides and nitrofurazone are the antibiotics of choice.

Known carriers should be isolated and treated. Cat quarters and runs should be washed daily with disinfectants and boiling water to destroy infective oocysts.

TRICHOMONIASIS

Trichomoniasis is caused by the protozoan *Tritrichomonas foetus*. In cats, *T. foetus* infects and colonizes the large intestines, and causes chronic, recurrent diarrhea, sometimes tinged with blood or *mucus*. Infection is most commonly seen in kittens and cats from catteries, where, presumably, the organism is spread among cats by close contact. There has been no evidence of spread from other species. Diagnosis is by fecal examination.

Treatment: Treatment with the various antiprotozoal drugs is usually unsuccessful. Most cats will slowly overcome the infection on their own. However, this can take nine months or more. It appears that most infected cats continue to shed low levels of the organism in their feces for many months after the diarrhea has resolved.

3

Infectious Diseases

Infectious diseases are caused by bacteria, viruses, protozoa, or fungi that invade the body of a susceptible host and cause an illness. These infectious agents are collectively known as *pathogens*.

Infectious diseases are often transmitted from one cat to another by contact with infected feces, urine, *mucus*, or other bodily secretions, or by inhaling pathogen-laden droplets in the air. A few are transmitted via the genital tract when cats mate. Others are acquired by contact with spores in the soil that get into the body through the respiratory tract or a break in the skin.

Although pathogens exist everywhere in the environment, only a few cause infection. Fewer still are contagious. Many infectious diseases are species-specific. For example, a cat cannot catch a disease that is specific to a horse, and vice versa. Other infectious diseases are not species-specific, so they are capable of causing disease in many animals, including humans. In instances where a disease is *zoonotic*, public health considerations will be discussed here.

Many infectious agents are able to survive for long periods outside the host animal. This knowledge is important in determining how to contain the spread of infection. For many diseases, the best way to prevent them is by vaccination. Immunity and vaccinations are discussed at the end of this chapter.

Bacterial Diseases

Bacteria are single-celled microorganisms that cause disease. Some bacterial diseases are discussed in the chapters on the body system they primarily affect.

SALMONELLA

This disease is caused by a type of bacteria that produces gastrointestinal infection in susceptible animals. It tends to affect kittens housed in crowded, unsanitary surroundings and cats whose natural resistance has been weakened by a viral infection, malnutrition, or other stress. Salmonella remain alive for many months or years in soil and manure. In cats, the disease is acquired by consuming raw or commercially contaminated foods, by licking animal manure off their feet or coats, or by making oral contact with surfaces that have been contaminated by the diarrhea of an infected cat. This bacterial infection is a risk for cats fed a raw diet, unless excellent food-handling hygiene is practiced at all times.

Signs of infection include high fever, vomiting and diarrhea (in 90 percent of cases), dehydration, and weakness. The stool may be bloody and foul smelling. Dehydration develops when vomiting and diarrhea are prolonged. Bacteria in the bloodstream can cause abscesses in the liver, kidneys, uterus, and lungs. Conjunctivitis will be seen in some cats. The acute illness, which lasts four to ten days, may be followed by a chronic diarrhea that persists for more than a month. Death will occur in about half of cases. Abortions have been reported.

Cats (and dogs) often are asymptomatic carriers. Bacteria shed in their feces can, under appropriate conditions, produce active infection in domestic animals and humans.

Diagnosis is made by identifying salmonella bacteria in stool cultures (carrier state) or in the blood, feces, and infected tissues of cats suffering acute infection.

Treatment: Mild, uncomplicated cases respond to correction of the dehydration, vomiting, and diarrhea. Antibiotics (chloramphenicol, amoxicillin, the quinolone class of antibiotics, and sulfa drugs) are reserved for severely ill cats. Antibiotics can *favor* the growth of drug-resistant salmonella species. When antibiotics are used, it is best to administer them via injection and not orally. This will minimize the chances of the cat developing resistant strains of this bacteria.

Intravenous fluids will be needed for severely ill cats. Even cats with mild cases of this type of infectious diarrhea may need subcutaneous fluids and replacement of electrolytes.

Prevention: Prevent the disease by housing cats in roomy, sanitary conditions where they can be well cared for and properly fed.

Public health considerations: Since this is a disease that can spread to people, excellent hygiene must be practiced when handling feces and cleaning litter boxes.

CAMPYLOBACTERIOSIS

Campylobacteriosis is a disease that produces acute infectious diarrhea in kittens. It also occurs in catteries and shelter cats—most of whom are in poor condition and are suffering from other intestinal infections.

The bacterium is acquired by contact with contaminated food, water, uncooked poultry or beef, or animal feces. *Campylobacter* species can survive for up to five weeks in water or unpasteurized milk.

The incubation period for disease is one to seven days. Signs of acute infection include vomiting and watery diarrhea that contains *mucus* and sometimes blood. The disease usually runs its course in 5 to 15 days, but may be followed by chronic diarrhea in which bacteria is shed in the feces.

Treatment: Treat mild diarrhea as described in *Diarrhea*, page 278. Keep the cat warm, dry, and in a stress-free environment. More severely affected cats will require veterinary management with intravenous fluids to correct dehydration. Antibiotics may be advisable. Erythromycin and ciprofloxacin are the current drugs of choice.

Public health considerations: Campylobacteriosis is a common cause of diarrhea in humans. Most human cases arise from contact with newly acquired kittens and puppies who are suffering from diarrhea. Parents should be aware that kittens with diarrhea may harbor *zoonotic* pathogens. Good hygiene is essential, especially for young children and people who are immunocompromised.

CLOSTRIDIUM PERFRINGENS

This is a spore-forming bacteria that produces a toxin. Because it forms spores that become airborne, this bacteria is more resistant to cleaning and environmental influences. The toxin causes an acute, watery diarrhea. Mucus and blood may be present, and the cat may be seen straining in the litter box.

Treatment: Tylosin, ampicillin, and metronidazole are antibiotics that may be used in treatment, but equally importantly, the cat's hydration must be maintained. Antibiotics may be needed for weeks in severe cases.

TETANUS

This disease is caused by *Clostridium tetani* bacteria. It occurs in all warm-blooded animals. It is rare in cats because they possess a high natural immunity. Tetanus bacteria are found in soil contaminated by horse and cow manure. They are also present in the intestinal tract of most animals, where it does not cause disease. Bacteria enter the skin via an open wound such as a bite or puncture. A rusty nail is a classic example. But any cut or injury that penetrates the full thickness of the skin can act as a point of entry.

Symptoms appear 2 to 14 days after initial injury. Tetanus bacteria grow best in tissues where the oxygen level is low (anaerobic conditions). The ideal environment is a deep wound that has sealed over or one in which there is devitalized tissue that is heavily contaminated with filth.

The bacteria make a neurotoxin that affects the nervous system. Signs of disease are due to this neurotoxin. In cats, tetanus is often a localized disease, with stiffness and rigidity in one leg—usually one with an obvious wound. This may spread to the other legs. In cats with generalized tetanus, signs include spastic contractions and rigid extension of the legs, difficulty opening the mouth and swallowing, and retraction of the lips and eyeballs. The tail sometimes stands straight out. Muscle spasms are triggered by almost anything that stimulates the cat. Death is caused by dehydration, exhaustion, and difficulty breathing.

Treatment: Fatalities from tetanus may sometimes be avoided by prompt, early veterinary care. Tetanus antitoxins, antibiotics, sedatives, intravenous fluids, and care of the wound alter the course for the better. Recovery can take four to six weeks, during which time the cat needs to be maintained in a dark, quiet environment to minimize stimulation.

Prevention: The disease can be prevented by prompt attention to skin wounds (see *Wounds*, page 47).

HELICOBACTER

Helicobacter pylori is the bacteria associated with gastric ulcers in humans. In cats, this bacteria may cause vomiting, diarrhea, and abdominal pain. Chronic, low-grade vomiting may be the most common sign, but many cats have this bacteria without any clinical signs.

A gastric *biopsy*, often done via *endoscopy*, is the best way to definitively diagnose this problem.

Treatment: Treatment involves famotidine (Pepcid) to help decrease stomach acid, and an antibiotic such as amoxicillin or metronidazole.

Public health considerations: While no direct connection has been made between human and feline cases, there are *Helicobacter* species that do occur in both.

TULAREMIA

Tularemia is an uncommon disease in cats caused by the bacteria *Francisella tularensis*. It occurs naturally in wild animals, especially rodents and rabbits. Cats (and dogs) usually acquire the disease from the bite of a blood-sucking tick or flea that has fed on an infected host. Direct contact with an infected wild animal or carcass is another route of infection, especially if the cat is allowed outdoors and hunts.

Cats with tularemia exhibit weight loss, fever, apathy and depression, lymph node enlargement, and signs of pneumonia. Oral ulcers may be noted. There may be an ulcerated skin sore at the sight of the insect bite. Some cats will have a discharge from the eyes and the nose and may even have a rash on the skin—most easily seen in the groin area.

Treatment: Antibiotics are the treatment of choice. Tetracycline, chloramphenicol, streptomycin, and gentamicin are effective. A long course of treatment may be necessary, and relapses can occur.

Prevention: Eliminating fleas and other insect parasites reduces the likelihood of infection (see *A Suggested Flea-Control Program*, page 138), as does preventing your cat from roaming and hunting. Wear rubber gloves and use strict hygienic precautions when handling cats with draining wounds. Surgical removal of the ulcerated skin lesion may be helpful.

Public health considerations: Infected cats can transmit the disease to humans through bites and scratches or by contact with draining skin ulcers. Tularemia is an occupational hazard for those who handle rabbit meat and pelts. This bacteria can survive even in frozen rabbit meat. Great care must be taken if cats are fed rabbit meat, especially from wild rabbits.

PLAGUE

Plague (bubonic plague) is a devastating disease caused by the bacteria *Yersinia pestis*. About 13 cases occur in humans in the United States each year, with some evidence that the disease is on the increase. Ninety percent of human cases occur in New Mexico, Arizona, and California. New Mexico accounts for 50 percent of reported cases annually. This disease is of concern because of potential cat-to-human transmission.

In nature, plague is perpetuated as fleas move from one rodent to another. Squirrels and prairie dogs are frequently infected. Cats, dogs, wild carnivores, and humans are accidental hosts. Cats and other carnivores acquire the disease by mouth contact with infected rodents or by the bite of infected fleas. Cats are highly susceptible to the disease, although in 50 percent of cases, the infection is mild or unapparent. The death rate in cats with severe illness is 30 to 50 percent.

Signs of severe illness in cats appear shortly after exposure. They include high fever, loss of appetite, apathy and depression, dehydration, mouth ulcers, coughing, and difficulty breathing. Large swellings (*bubos*, hence the name bubonic plague) involve the lymph nodes, especially those beneath the jaw. These swellings form abscesses that drain infective material. This is the most common form. Plague can also show up as a *septicemic* disease in the bloodstream or pneumonic plague in the lungs. In that case, cats may spread the disease by coughing out infected air droplets.

Diagnosis is established by chest X-ray, blood and tissue cultures, gram stains, and serial antibody *titers* to *Y. pestis*.

Treatment: Great care must be taken by all people involved in the care of a plague-infected cat. Strict hygienic and isolation precautions under professional guidance are required. Hospitalization and veterinary management are imperative. Because the disease can be rapidly fatal, treatment is started before the diagnosis is confirmed by a laboratory. *Y. pestis* is susceptible to a number of antibiotics, including streptomycin, gentamicin, doxycycline, tetracycline, and chloramphenicol (but not penicillins). Antibiotics may need to be given for weeks.

Prevention: Control of fleas is of prime importance (see *A Suggested Flea-Control Program*, page 138). Exposure to plague can be minimized by preventing cats from roaming and hunting. This restriction is especially important in plague-endemic areas.

Public health considerations: The most common mode of transmission to humans is the bite of an infected flea. Cats (and dogs) may transport the flea from plague-infected wildlife. Sick cats may transmit the bacteria through bites or scratches. Cats with pneumonia may transmit the disease through droplet formation from sneezing and coughing. Handling an infected cat may result in transmission through breaks in your own skin or contact with mucous membranes. Fleas and external parasites are also a danger to personnel treating the cat, and should be rapidly extinguished by appropriate insecticide treatment.

All individuals who have handled, contacted, or participated in the care of a plague-infected animal should contact a physician immediately; prophylactic antibiotics may be required.

TUBERCULOSIS

This rare disease in cats is caused by the tubercle bacillus (*Mycobacterium*). There are three strains of bacilli that produce disease in humans, but only the bovine type (*M. bovis*) and the avian type (*M. avian*) infect cats. Cats are resistant to infection by the human type (*M. tuberculosis*). Avian tuberculosis is not common.

Tuberculosis in cats is usually acquired by ingesting infected cow's milk or by eating contaminated uncooked beef. Even though there has been a steady decline in tuberculosis with pasteurization of milk and elimination of this disease from dairy herds, it has not been completely wiped out.

Feline tuberculosis (*M. bovis*) is primarily a gastrointestinal problem. Common signs include low-grade fever with chronic wasting and loss of condition despite good care and feeding. Abscesses form in the intestinal lymph nodes and liver. Lung infection may also occur. Occasionally, an open wound

becomes infected, leading to skin involvement with draining sinuses and a discharge containing bacteria.

Respiratory tuberculosis causes rapid labored breathing, shortness of breath, and production of bloody sputum.

The finding of tubercle bacilli in the feces, in sputum, or in drainage from a wound makes the diagnosis. Special stains are needed when looking at samples on a slide under a microscope. A chest X-ray may be suggestive. The tuberculin skin test is not reliable in cats. A new blood test for nitric oxide may be useful for cats suspected of having tuberculosis.

Treatment: Treatment, which involves antituberculous drugs, is difficult and prolonged.

Public health considerations: Humans can also become infected from *M. bovis*. Therefore, the hazard to human health often makes euthanasia of an infected cat the wisest choice.

BORDETELLA

Bordetella bronchiseptica is a cause of upper respiratory infection in cats. This bacteria is present in normal, healthy cats as well, so it seems to be a problem secondary to viral upper respiratory infections. Rarely, pneumonia will develop.

This illness is more severe in young cats and in shelters or situations with crowding, poor ventilation, and stress. Clinical signs include lethargy, fever, anorexia, coughing, sneezing, discharges from the eyes and nose, and swollen lymph nodes under the chin. Difficulty breathing suggests pneumonia.

Treatment: Supportive care is important, with antibiotics if needed. (See chapter 10 for more information.) An intranasal vaccine is available.

FELINE PNEUMONITIS (FELINE CHLAMYDIOSIS)

At one time, *Chlamydophila felis* (formerly called *Chlamydia psittaci*) was thought to be a major cause of feline respiratory disease. However, current research has shown that this bacteria-like organism can cause conjunctivitis and a relatively mild, persistent upper respiratory disease called feline pneumonitis. The primary clinical sign is conjunctivitis with a discharge that will change from *serous* to *purulent*. This is most often seen in kittens up to 3 months of age. A respiratory form of the disease is sometimes seen as well, usually secondary to a viral upper respiratory infection.

Treatment: Tetracycline drugs are used, including ophthalmic preparations. There is a vaccine, but it is not generally recommended because of the high incidence of adverse reactions and the relative infrequency of chlamydial infection in North America.

Feline chlamydiosis is a common cause of conjunctivitis in kittens. Typically, their eyelids are pasted shut.

Feline Mycoplasmal Infection

Mycoplasma felis may cause an upper respiratory infection with conjunctivitis and a nasal discharge. This may be bilateral, or just on one side. The infection may resolve spontaneously in two to four weeks. This infection may occur secondary to a viral upper respiratory infection.

Treatment: Tetracyclines, including ophthalmic preparations, can be used for treatment if the illness does not resolve on its own.

Feline Infectious Anemias

Cytauxzoon felis and *Mycoplasma haemophilus* (previously known as *Hemobartonella felis*) are two infectious causes of anemia in cats. See chapter 11 for information on these diseases.

Feline Upper Respiratory Diseases

Signs	Herpesvirus	Calicivirus	Bordetella	Mycoplasma
Length of illness	2 to 4 weeks	1 to 2 weeks	1 to 2 weeks	2 to 4 weeks
Nasal	Sneezing, discharge	Discharge	Cough, sneezing	Discharge
Eyes	Conjunctivitis, corneal ulcers	Discharge	Discharge	Conjunctivitis
Mouth	Drooling	Ulcers, chronic gingivitis	None	None
Fever	Yes	Sometimes	Mild	Yes
Pneumonia	Rare	Common	Sometimes	Rare
Lethargy	Severe	Mild	Mild	Mild
Unusual signs	None	Lameness	Enlarged lymph nodes	Nasal discharge may be unilateral

Viral Diseases

FELINE VIRAL RESPIRATORY DISEASE COMPLEX

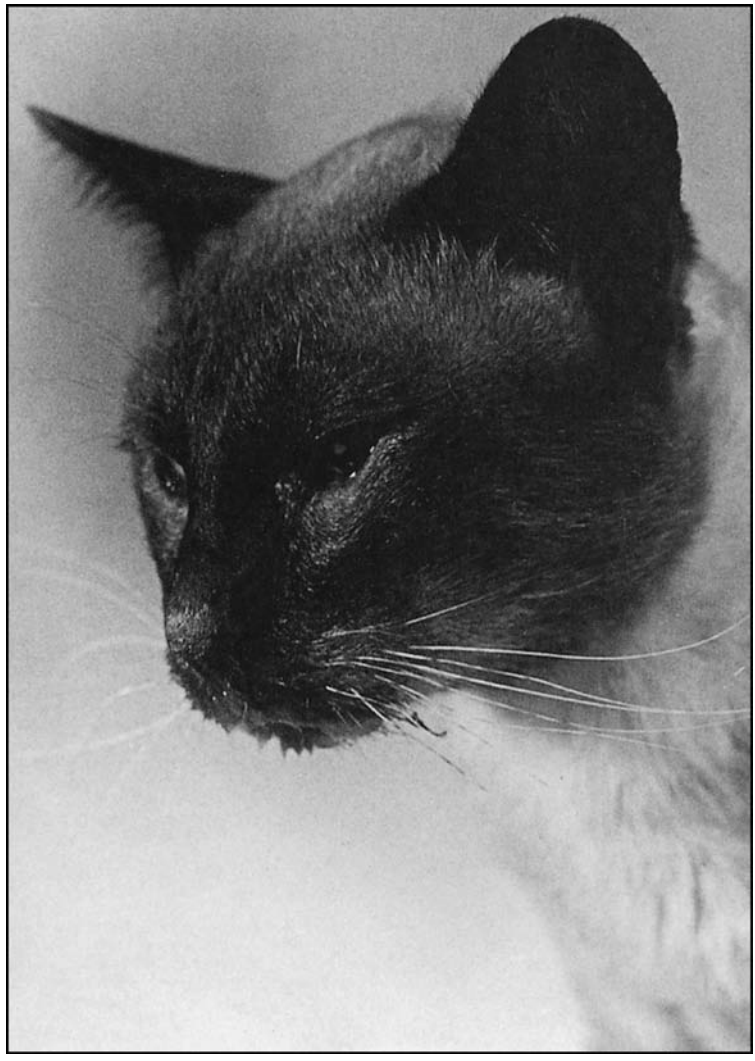
Feline viral respiratory diseases are highly contagious, often serious illnesses of cats that can spread rapidly through a multicat home, a cattery, or a shelter. They are one of the most common infectious disease problems a cat owner is likely to encounter. Although few adult cats die of upper respiratory disease, the death rate among young kittens approaches 50 percent.

Although these diseases are highly contagious among cats, they cannot be transmitted to humans. Cats also cannot catch our colds. This is because the viruses that attack cats do not affect humans, and vice versa.

Recently, it has been recognized that two major viral groups are responsible for the majority of clinical upper respiratory infections in cats (80 to 90 percent). The first is the herpesvirus group, which includes feline viral rhinotracheitis (FVR). The second is the calicivirus group, which includes feline caliciviral disease.

Other viral agents, especially those of the reovirus group, cause feline viral respiratory illness. They account for a minority of cases.

There are two distinct stages in the feline viral respiratory disease complex. The acute stage is followed by the chronic carrier state.



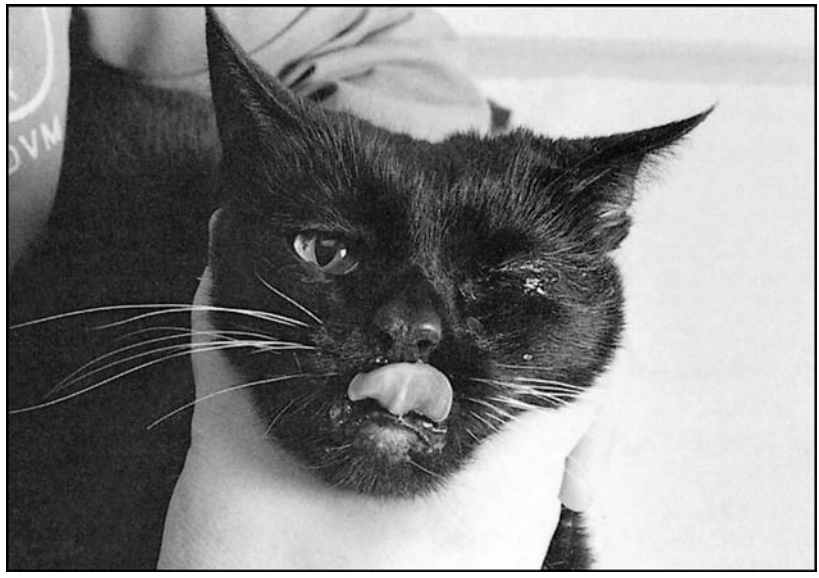
A cat with an acute upper respiratory infection, typified by discharge from the eyes, nose, and mouth.

Acute Viral Respiratory Infection

There is considerable variation in the severity of illness. Some cats have mild symptoms, while in others the disease is rapidly progressive and sometimes fatal.

The disease is transmitted from cat to cat by direct contact with infected discharge from the eyes, nose, mouth; by contaminated litter boxes, water bowls, and human hands; and rarely, by airborne droplets. The virus is stable outside the host for as short as 24 hours or as long as 10 days, depending on conditions.

Regardless of which virus is responsible for the infection, the initial signs are similar. The infected organism can be identified only by viral or *serologic*



Upper respiratory infection with a severely inflamed eye, characteristic of the herpesvirus.

tests. These tests are not always available quickly enough to be of use in planning treatment.

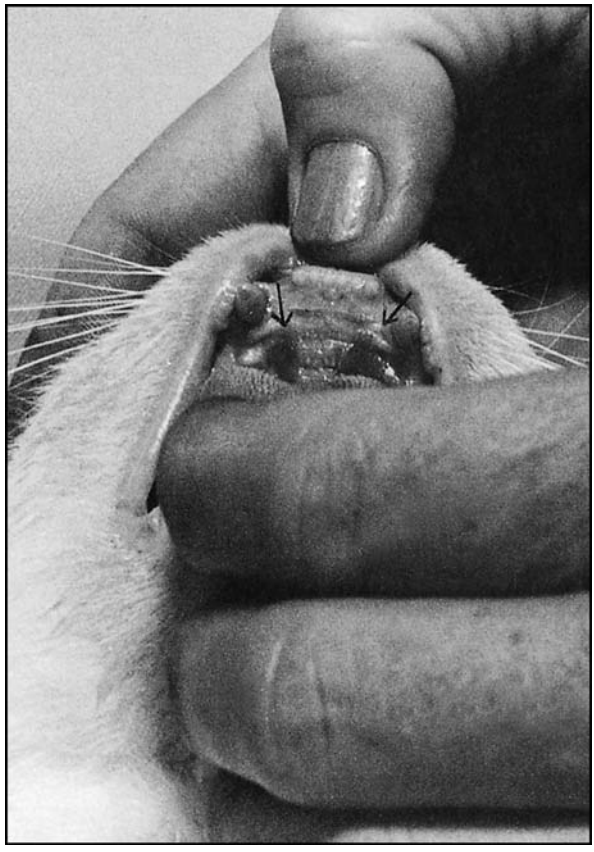
Clinical signs appear 2 to 17 days after exposure and reach maximum severity 10 days later. Illness begins with severe bouts of sneezing lasting one to two days. This is followed by conjunctivitis and watery discharge from the eyes and nose, which may suggest a cold or flu. By the third to fifth day, a cat exhibits fever, apathy, and loss of appetite. The eye and/or nasal discharge becomes *mucoid* or *purulent*. Cats with obstructed nasal passages breathe with their mouths open.

Further signs depend on the particular respiratory virus in question. A cat with herpesvirus develops a spastic cough. If the surface of the eye is severely inflamed, the cat may develop keratitis or corneal ulcerations.

In a cat with calicivirus, you may see ulceration of the mucous membranes of the mouth (stomatitis). This is particularly disabling, because the cat loses his taste for food and refuses to eat and drink. Drooling is common. Shortness of breath and viral pneumonia can occur. Secondary bacterial infection, dehydration, starvation, and rapid weight loss are all complications that can lead to death.

A diagnosis can be suspected from the clinical signs. It can be confirmed by isolating the virus from the throat or by specific *serologic* blood tests. Because these diseases are highly contagious, these tests are most important when the disease involves a cattery, a shelter, or a multicat household.

Treatment: Cats suspected of having acute viral respiratory infection should be strictly isolated for three to four weeks so as not to infect others. It



The ulcers on the roof of the cat's mouth are caused by the calicivirus.

is important to disinfect any bedding, bowls, cages, or other items the sick cat has come into contact with by washing them thoroughly with a dilute solution of bleach and water. Human caretakers should change their clothing, wear disposable shoe covers, and wash their hands frequently.

For the patient, rest and proper humidification of the atmosphere are important. Confine your cat in a warm room and use a home vaporizer. A cool steam vaporizer offers some advantage over a warm vaporizer because it is less likely to cause additional breathing problems. At the very minimum, keeping the cat in the bathroom while you shower will help.

Because dehydration and anorexia seriously weaken a cat, it is important to encourage eating and drinking. Feed highly palatable foods with a strong smell, such as tuna-flavored foods or strained baby food (make sure it doesn't contain onion powder), diluted with water. Supplemental fluids can be given using a syringe (see *How to Give Medications*, page 556). Once the cat begins to eat and drink again, the worst danger is past.

Clean secretions from the eyes, nose, and mouth with moist cotton balls as often as needed.

Shrink swollen nasal membranes by administering Afrin Children's Strength Nose Drops (.025 percent; see *Over-the-Counter Drugs for Home Veterinary Use*, page 561, for dosage). Administer just one drop to one nostril the first day. The next day, put one drop in the other nostril. The medicine is absorbed and works on both nasal passages. Continue to alternate between nostrils. Administer cautiously to prevent rebound congestion and excessive drying out of the mucous membranes. Use the decongestant for no more than five days.

If the cat becomes dehydrated, refuses to eat, loses weight, or does not respond to home care, *seek prompt veterinary help*.

Antibiotics are important to manage moderate to severe respiratory infections by treating secondary bacterial infections when present. Antibiotics are not needed or recommended for mild upper respiratory infections. Amoxicillin-clavulanate and doxycycline are good choices. Antibiotics must be prescribed by a veterinarian. L-Lysine is an amino acid that may help clear the infection if it is related to herpesvirus.

Chronic Carrier State

Almost all the cats who have been infected with FVR will become chronic carriers. FVR lives and multiplies in the cells lining the throat. During periods of stress (such as illness, anesthesia, surgery, lactation, medication with steroids, or even emotional stresses), the cat's immunity breaks down and the virus is shed in mouth secretions. At this time, the cat may exhibit signs of a mild upper respiratory illness.

Calicivirus can be shed continuously, and 80 percent of cats who have had calicivirus will continue to be chronic carriers. Cats infected with calicivirus therefore present an especially serious hazard to other cats living on the premises. Periodic outbreaks are likely to occur.

Prevention: Separating virus-positive cats from a breeding colony or household is difficult. Several months of segregation and testing are required. Cats who are newly entering a household or cattery present a further potential source of infection. Such cats should be placed in strict isolation for 10 to 14 days and observed for signs of infection. A cat admitted as a boarder should be housed in separate quarters and handled and fed separately from the other cats. All cats should be routinely tested for feline leukemia and feline immunodeficiency virus. Well-ventilated surroundings and ample living space to avoid crowding are important in good cattery management, as are strict hygiene and frequent disinfection of dishes and living areas.

The most effective step by far is to vaccinate all cats, but even then, control is not 100 percent. Vaccination will not eliminate the chronic carrier states. For more information on these vaccines, see *Feline Viral Respiratory Disease Complex*, page 108.

VIRULENT SYSTEMIC FELINE CALICIVIRUS

A new mutation of the calicivirus has been identified in various outbreaks in cats. The first outbreak was in California, but outbreaks have since been identified across the United States. The calicivirus in these cases seems to have mutated to a more virulent form, and is therefore now known as virulent systemic feline calicivirus (VS-FCV).

The virus may be shed in feces, sloughed skin and hair, and nasal, ocular, and oral secretions. Asymptomatic and mildly affected cats may transmit the fatal disease to other cats; therefore, all exposed cats should be considered a potential infectious risk. This virus is very contagious and easily spread by both direct contact and on clothes, dishes, bedding, and other objects. Strict hygiene is required to stop the spread in outbreaks.

Along with respiratory signs, cats will show a high fever, *edema* of the face and limbs, and ulceration and hair loss on the face, feet, and pinnas. There may also be other signs seen with more typical feline upper respiratory diseases, including nasal and ocular discharge, oral ulceration, anorexia, and depression.

A secondary immune response is believed to be responsible for the organ damage that accompanies these signs, and leads to a 60 percent fatality rate. The mortality rate is higher in adults than it is in kittens.

Although this syndrome remains uncommon, occasional outbreaks and clusters of cases have been documented throughout the United States. So far, this has occurred in cats of all ages, including those vaccinated for the common calicivirus as well as nonvaccinates. No other species is known to be affected by this strain of calicivirus. There is no known risk to human health.

Treatment: For affected cats, treatment consists of supportive care, along with drug therapy using steroids and interferon. Bovine lactoferrin may be useful. The efficacy of these treatments is not yet known.

Prevention: Isolate all cats suspected of being infected. VS-FCV can survive up to four weeks in the environment and is resistant to some disinfectants, but a bleach solution (diluted with water at 1:32) has been used to effectively contain previous outbreaks. All surfaces should be thoroughly cleaned and disinfected. Do not introduce any new cats for at least four weeks.

A new vaccine from Fort Dodge Animal Health, called CaliciVax, has recently been licensed for control (see page 108).

FELINE PANLEUKOPENIA

Feline panleukopenia, also called feline infectious enteritis, is a leading cause of death in kittens. It has been called feline distemper, but it bears no relation to the virus that causes distemper in dogs. There may, however, be crossover infectivity between cats and the newer forms of parvovirus isolated in dogs.

Panleukopenia virus is present wherever there are susceptible animals. Mink, ferrets, raccoons, and wild cats all serve as a reservoir. The virus is highly contagious. It is spread by direct contact with infected animals or their secretions. Contaminated food dishes, bedding, litter boxes, and the clothes or hands of people who have treated an infected cat are other routes of exposure.

The panleukopenia virus has a special affinity for attacking white blood cells. The reduction of circulating white cells (leukopenia) gives the disease its name. Signs of acute illness appear two to ten days after exposure. Early signs include loss of appetite, severe apathy, and fever up to 105°F (40.5°C). The cat often vomits repeatedly and brings up frothy, yellow-stained bile. The cat may be seen crouching in pain, his head hanging a few inches over the surface of the water bowl. If he is able to drink, he immediately vomits. With pain in the abdomen, the cat cries plaintively.

Diarrhea may appear early in the course of the disease, but frequently comes on later. The stools are yellow or blood-streaked. In young kittens (and some older cats), the onset can be so sudden that death occurs before the owner realizes the cat is ill. It may seem as if the cat was poisoned.

Panleukopenia can be transmitted to kittens both before and shortly after birth. In such cases, the mortality rate is 90 percent. Kittens recovering from neonatal infection may have cerebellar brain damage and exhibit a wobbly, jerky, uncoordinated gait that is noted when they first begin to walk. Secondary bacterial infections are common. The bacterial infection, rather than the virus itself, may be the cause of death.

A white blood cell count confirms the diagnosis. In-office tests for canine parvovirus will also detect feline panleukopenia virus, which is a member of the parvovirus family.

Cats who survive are solidly immune to reinfection but can shed the virus for several weeks. Along with asymptomatic carriers, this leads to repeated exposure in a population of cats. The repeated exposure helps to boost immunity among cats who have already acquired protective antibodies, by continuing to stimulate their immune systems.

Treatment: Detecting panleukopenia early in the course of the illness is of prime importance, because intensive treatment must be started at once to save the cat's life. It is better to consult your veterinarian on a false alarm than to wait until the cat is desperately ill. Supportive measures include fluid replacement, antibiotics, maintaining nutrition, and, occasionally, blood transfusions.

Prevention: The panleukopenia virus is hardy. It can survive in carpets, cracks and furnishings for more than a year. It is resistant to ordinary household disinfectants but can be destroyed using a bleach solution (diluted with water at 1:32).

Most cats are exposed to panleukopenia sometime during their life. Vaccination is the most effective way to prevent serious infection (see page 107).

FELINE INFECTIOUS PERITONITIS

Feline enteric coronavirus (FeCV) is a common disease of wild and domestic cats that is caused by a member of the coronavirus group. The disease is spread from cat to cat, but requires close and continuous contact with infective secretions. The incubation period is two to three weeks or longer, but 75 percent of cats exposed experience no apparent infection. Among those who do, a mild respiratory infection, with a runny nose or eye discharge, is the most common sign.

Cats who recover from mild infection can become asymptomatic carriers. Most cats who have been infected in this way are not immune to future infections with the coronavirus. It is estimated that 30 to 40 percent of all cats are positive for antibodies to FeCV, with that rising to 80 to 90 percent in catteries.

Fewer than 1 percent of all exposed cats will develop the secondary fatal disease known as feline infectious peritonitis (FIP). Why some cats develop FIP and others do not is not known for sure. It is believed that FIP is a mutation of the benign coronavirus and is therefore not contagious. The virus may change from benign to virulent weeks, months, or even years after the initial exposure to the coronavirus. Factors that seem to play a part in the change from benign to virulent are a genetic predisposition, exposure to chronic shedding of the virus, and living in a multicat environment, which could mean more stress.

Genetic susceptibility is *polygenic*. One study suggested that Persians and Birmans have an increased incidence, but other studies say Abyssinians, Bengals, Birmans, Himalayans, Ragdolls, and the Rex breeds are especially at risk. Pedigreed cats, in general, do seem to be at higher risk, but that may relate to the fact that they are often housed in catteries.

It is known that FIP tends to most often affect kittens, cats between 6 months and 2 years of age, and cats older than 14 years of age. Neonatal FIP has been implicated as a cause of fading kittens (see page 472). There is a higher rate of infection in catteries, where conditions are apt to be crowded and there is greater opportunity for continuous and prolonged exposure. Cats who are poorly nourished, run-down, or suffering from other illnesses, such as feline leukemia, are most susceptible. These factors may lower the cat's natural resistance to FIP.

Despite its name, FIP is not strictly a disease of the abdominal cavity. The virus acts on capillary blood vessels throughout the body—especially those of the abdomen, chest cavity, eyes, brain, internal organs, and lymph nodes. Damage to these minute blood vessels results in loss of fluid into tissues and body spaces. FIP tends to run a prolonged course. It may go on for weeks before signs are evident. The immune system of the infected cat plays a part in the disease. Cats have both cell-mediated and humoral (antibody) immunity. In cats with FIP, the system backfires and normal cells are targeted for destruction.

FIP occurs in two forms—wet and dry—both of which are invariably fatal.

Wet form early signs are nonspecific and mimic several other feline disorders. They include loss of appetite, weight loss, listlessness, and depression. The cat appears to be chronically ill. As fluid begins to accumulate in the body spaces, you may notice labored breathing from fluid in the chest or abdominal enlargement from fluid in the abdomen. Sudden death may occur from fluid in the heart sac. Other signs that accompany the wet form are fever up to 106°F (41°C), dehydration, anemia, vomiting, and diarrhea. Jaundice and dark urine are caused by liver failure.

Dry or disseminated form early signs are similar to those of the wet form, except fluid is not produced. The disseminated form is even more difficult to diagnose. It affects a variety of organs, including the eyes (15 percent of cases affect the eyes only), brain, liver, kidney, and pancreas. Sixty percent of dry form cases will show eye or brain involvement, or both.

At surgical exploration, which may be necessary to make the diagnosis, sticky mucus or strands of fibrous protein may be found on the surface of the liver, spleen, or intestines. Previously, 10 to 20 percent of cats with the dry form were also infected with the feline leukemia virus. With more testing and control of FeLV that number is down to less than 5 percent.

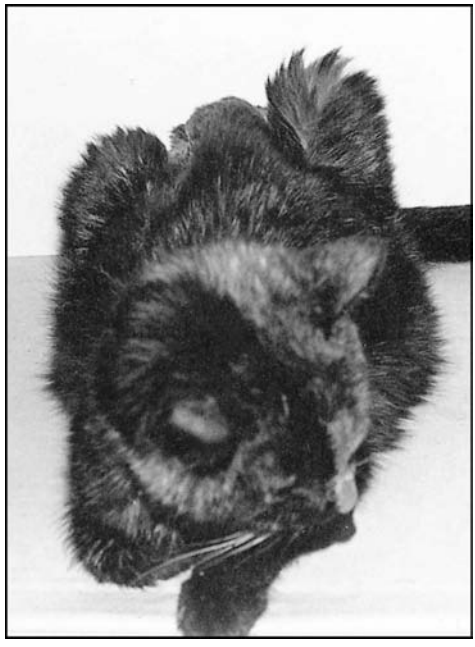
The diagnosis of FIP can be suspected based on typical clinical signs along with an abnormal blood count, liver function tests, and an abnormal serum protein pattern. Analysis of peritoneal (chest) fluid, if present, is helpful. *Serologic* blood tests to detect coronavirus antibodies are not always conclusive and can lead to false positive interpretations. So far, no tests are consistent in identifying *titers* due to the benign presence of the virus, the virulent virus, or vaccination antibodies. The only certain way to confirm the diagnosis is by organ biopsy. In the wet form, fluid aspirated from the chest or abdomen may be highly suggestive of the diagnosis.

Treatment: Unfortunately, once a cat develops signs of secondary disease (either the wet or dry form), he will die. The wet form is worse, with cats often dying within two months. Cats with the dry form may have up to a year of good quality life. The cat can be made more comfortable by using medications; life may be prolonged with chemotherapy drugs such as cyclophosphamide or immunosuppressive doses of cortisone. Interferon and vitamin supplementation, especially vitamin C, can be helpful. Some cats do well with low-dose aspirin to reduce inflammation. Pentoxifylline (Trental) is being used by some veterinarians to treat the damage to blood vessels.

Prevention: Physical and environmental stresses lower a cat's immunity and increase susceptibility to the virus, so it is important to maintain good nutrition, control parasites, treat health problems promptly, and groom regularly.

FIP presents its greatest hazard in multicat families, shelters, boarding establishments, and catteries. The dried virus can survive for weeks in the environment. Fortunately, the virus is easily killed by household disinfectants. A bleach

Abdominal enlargement in a cat with the wet form of feline infectious peritonitis.



Note the extreme depression, muscular wasting, and prominence of the backbone in this cat with FIP.

solution (diluted with water at 1:32) is a good disinfectant. Disinfect cat quarters regularly. Provide a spacious enclosure for each cat and allow ample opportunity for exercise.

Routine FIP testing of all cats in a multicat household or cattery is often an exercise in frustration. Kittens can be tested for coronavirus antibody at 12 to 16 weeks.

A new cat arriving in the household can be isolated for two weeks and tested for FIP. No healthy cat should be removed due to a positive corona virus titer, however, because there is no way to tell if the virus is the benign or virulent form from a titer.

FIP is an active area of research in the feline community and there are special research funds that can always benefit from donations. (The Winn Feline Foundation has such as fund. See appendix D.) An intranasal modified live vaccine is now available (see page 111), but it is not currently recommended as part of the routine vaccination schedule because its effectiveness has not been proven.

FELINE LEUKEMIA VIRUS DISEASE COMPLEX

The feline leukemia virus (FeLV) is responsible for more cat diseases than any other infectious agent and is second only to trauma as the leading cause of death in household cats. It is the most important cause of cancer in cats (see chapter 19) and significantly contributes to the severity of other feline diseases. The virus is transmitted from one cat to another by infected saliva. Sharing water bowls or food dishes, cat-to-cat grooming, and cat bites can also spread the disease. The virus can be shed to a lesser extent in urine and feces. Kittens can acquire the virus *in utero* and through infected mother's milk.

The incidence of active infection varies. About 1 to 2 percent of healthy, free-roaming cats are infected. In multicat households and in catteries, the incidence may be higher, in some cases with 20 to 30 percent of cats showing the presence of FeLV virus in the blood. About 50 percent show neutralizing antibodies, indicating prior infection from which the cat has recovered. Ill feral or free-roaming urban cats may have an incidence as high as 40 percent.

Repeated or continuous exposure is necessary for transmission of the disease. For healthy adult cats, very prolonged exposure is required to develop infection. Kittens and young cats have less resistance. The virus does not appear in blood tests until a cat has been exposed for at least four weeks. After 20 weeks of exposure, 80 percent of cats are infected. In others, it may take up to a year. Environmental stresses, including illness, overcrowding, and poor sanitation, play a role in weakening a cat's resistance to the virus and make infection more likely.

The feline leukemia virus has three subgroups. A single cat may have one or more of these subgroups. Subgroup A is the most common, and this type is responsible for the immunosuppression that leaves FeLV-positive cats open to many infections. Subgroup B, when combined with subgroup A, is responsible for many of the FeLV-associated cancers. Subgroup C is the least common form and is responsible for severe anemias and bone marrow damage.

Feline oncovirus-associated cell membrane antigen (FOCMA) is a protein found on some feline cancer cells and is seen in both FeLV-positive and FeLV-negative cats. Cats who have antibodies to this protein are protected from certain cancers, such as lymphomas. However, they are not protective against FeLV infection or other FeLV-related diseases.

Signs of Illness

The initial illness lasts 2 to 16 weeks. Signs are nonspecific and include fever, apathy, and loss of appetite and weight. Other signs are vomiting and constipation or diarrhea. Some cats develop enlarged lymph nodes, anemia, and pale mucous membranes. Death at this stage is not common and signs may be so mild that they are missed.

Following exposure to the virus, there are four possible outcomes for cats:

1. About 30 percent of cats do not develop an infection at all—whether due to resistance or inadequate exposure is not known.
2. About 30 percent of cats develop a transient *viremia* with infectious virus present in their blood and saliva for less than 12 weeks. This stage is followed by the production of neutralizing antibodies that extinguish the disease. These cats are cured, cannot transmit the disease, have a normal life expectancy, and are at no increased risk of developing FeLV-related diseases.
3. About 30 percent of cats develop a persistent viremia with infectious virus present in their blood and saliva for more than 12 weeks. Persistently viremic cats do not mount an effective antiviral immune response and are susceptible to a number of diseases that are invariably fatal. About 50 percent die within six months and 80 percent succumb within three and a half years. These cats shed the virus while they are alive.
4. About 5 to 10 percent of cats develop a latent infection. These cats are able to produce virus-neutralizing antibodies that eliminate the virus from blood and saliva but do not extinguish the virus completely. The virus persists in the bone marrow and in T-cell lymphocytes. Over many months, the majority of latent-infected cats overcome and extinguish the virus, so the incidence of latent infection after three years is quite low. In latent-infected cats, the disease can become activated during

periods of stress or concurrent illness, leading to a recurrence of viremia. Cats who remain persistently latent are at increased risk for developing FeLV-associated diseases. Queens who have a latent infection may infect their kittens *in utero* or while nursing.

In cats with persistent viremia, the FeLV virus suppresses the cat's immunity, thereby allowing other diseases to develop. Diseases potentiated by the FeLV virus include feline infectious peritonitis, feline infectious anemia, feline viral respiratory disease complex, toxoplasmosis, chronic cystitis, periodontal disease, and opportunistic bacterial infections. The virus can also cause bone marrow suppression with anemia and spontaneous bleeding.

Maternally transmitted infection is responsible for some cases of reproductive failure, including repeated abortion, stillbirth, fetal reabsorption, and fading kitten syndrome.

About 30 percent of cats with persistent viremia develop a virus-related cancer months or years after exposure. Lymphosarcoma is the most common variety. One or more painless masses may be felt in the abdomen. There may be enlargement of lymph nodes in the groin, armpit, neck, or chest. The cancer may spread to the eyes, brain, skin, kidneys, and other organs, producing a variety of symptoms.

Leukemia is another malignant transformation. It is defined as rapid and uncontrolled growth of white blood cells. It may be accompanied by anemia and other changes in the blood-cell picture. It is much less common than lymphosarcoma.

Diagnosing FeLV

Currently, there are two tests available to detect FeLV infection.

1. The IFA test, performed by a reference laboratory, detects virus antigen in infected white blood cells. This indicates that the bone marrow is infected and there is a high probability that the cat is persistently viremic and is shedding the virus in his saliva, making him infective to other cats. About 97 percent of IFA-positive cats remain viremic for life and never extinguish the virus.
2. The *ELISA* test detects virus antigen in whole blood, serum, saliva, and tears. Blood is the recommended sample for testing. A rapid screening leukemia test kit is available for home and veterinary clinic use. The ELISA test is more likely to detect weak, early, or transient infections.

The common practice is to screen for FeLV using the ELISA test. If positive, the cat may have a transient viremia from which he will recover completely, or he may be in the early stages of a progressive infection. A positive ELISA test should be confirmed with an IFA test. A positive IFA test indicates that the cat is shedding virus and is capable of infecting others.

The ELISA test should be repeated in 8 to 12 weeks to see if the virus has been eliminated. The IFA test should also be repeated at this time because if the cat was in an early stage of infection, the IFA initially may not have been positive but may become so after 12 weeks.

Cats with latent infection test negative on both the ELISA and IFA tests. This is because the virus is absent in both serum and white cells. The only way to diagnose a latent infection is to remove a sample of the cat's bone marrow containing the dormant virus and grow the cells in culture.

Vaccination does not interfere with FeLV testing results.

Treating FeLV

Despite research, there is currently no effective treatment for FeLV. Cats who are healthy but FeLV-positive can live long, full lives in many cases. They need excellent care, including parasite control, a strictly indoor life, top-quality nutrition, regular grooming, and minimal stress.

Once ill, there are limited options. These include the drugs ImmunoRegulin, interferon, and acemannan.

Cancers produced by the FeLV virus cannot be cured and FeLV-positive cats with associated cancers have an average survival time of only six months, even with extensive treatment. Early diagnosis may allow successful relief, but not cure, in some individuals. Treatment includes antibiotics, vitamin-mineral supplements, transfusions, and anticancer drugs. Cats who respond to the medications may be made more comfortable and their lives may be prolonged. Unfortunately, there is no way to know in advance which cats are likely to respond. Such cats will continue to shed virus and thus present a hazard to the health of other cats with whom they come in contact.

Controlling and Preventing FeLV

Control depends first on accurate identification and removal of all virus-positive cats from multicat households, shelters, and catteries. Vaccination programs are secondary. FeLV vaccines are not as effective as some other vaccines, but do provide some protection (see page 109).

The following steps may prevent the spread of infection in a cattery, shelter, or isolated cat colony.

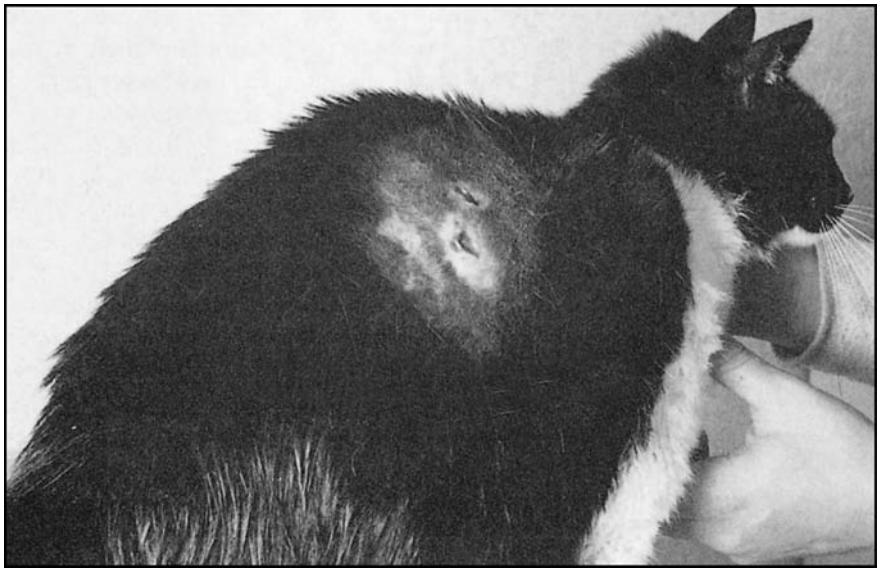
- Do not introduce new cats into the group without first testing them.
- IFA test all cats on the premises and repeat the test in three months. Remove all cats who test positive after each test. All positive cats should be isolated and retested after three months.
- All cats with two negative tests are considered free of active disease and not likely to transmit the disease to other cats. Retest annually.
- Do not allow new cats into the colony until they have been quarantined, tested twice (three months apart), and found to test negative.

- Toms and queens should be certified free of virus before being bred.
- Clean and disinfect the house, bowls, bedding, and cat quarters with ordinary household detergents or bleach solution. The FeLV virus is not hardy and is easily killed. Be sure to disinfect spots the cat might have soiled with urine, saliva, or feces.

There is no evidence that FeLV has ever caused an illness in humans. However, the virus does replicate in human tissue cells in the laboratory. In theory, children and patients with immune deficiency diseases could be at risk. As a sensible precaution, such individuals, and women who are pregnant or are considering becoming pregnant, are advised to avoid contact with virus-positive cats.

FELINE IMMUNODEFICIENCY VIRUS

The feline immunodeficiency virus (FIV), first discovered in a northern California cattery in 1986, is a major cause of chronic immunodeficiency in cats. FIV is a retrovirus belonging to the lentivirus family. It is related to the HIV virus in humans (the virus that causes AIDS). However, these two viruses are species-specific. *HIV does not produce disease in cats and FIV does not produce disease in humans*.



FIV infection is believed to be transmitted by cat bites, such as the one causing this infected wound.

Although its exact incidence has yet to be determined, FIV has been found in cats throughout the United States and is believed to affect 2 to 4 percent of cats in the general population. The incidence is highest in outdoor cats and in males 3 to 5 years of age. This suggests that cat bites, occurring during fights among toms, are a source of virus transmission, especially since the virus is shed in saliva.

Close or casual contact alone is not a major mode of transmission. There is no evidence that the disease is transmitted by mating. However, if a queen becomes infected while pregnant, she may pass the virus on to her unborn kittens.

Signs of Illness

Four to six weeks after FIV exposure, there is acute illness characterized by fever and swelling of the lymph nodes. The white cell count is below normal. The cat may have diarrhea, skin infections, and anemia. After the acute infection, there is a latent period from several months up to 12 years during which the cat appears to be healthy. Eventually, signs of a chronic immunodeficiency syndrome appear and progress slowly (again, over a period of months or years).

Cats with chronic FIV infection present with a variety of unexplained signs of ill health, including severe mouth and gum disease, long-standing diarrhea, loss of appetite and weight with emaciation, fever, recurrent upper respiratory infections with eye and nasal discharge, ear canal infections, and recurrent urinary tract infections. These signs are similar to those associated with other immunodeficiency disorders, such as feline leukemia, severe malnutrition, immunosuppressive drug therapy, and widespread cancer. About 50 percent will have chronic oral conditions and about 30 percent will have chronic upper respiratory infections. Ten to 20 percent will have diarrhea. Many will show neurological signs such as dementia. FIV-infected cats also are much more likely to develop lymphoma.

Diagnosing FIV

If antibodies to FIV are found in the cat's serum using an *ELISA* test, it can be assumed that the cat is persistently *viremic* and can be a source of infection to other cats, or has been vaccinated with the FIV vaccine. All ELISA-positive tests should be confirmed with another test, such as an IFA or Western blot immunoassay, performed at a reference laboratory. However, even these tests cannot distinguish vaccinated cats from infected cats. Research continues for a test that will distinguish between truly infected cats and cats who have been vaccinated.

There are two sets of circumstances in which these tests may have a false negative result. One is during the terminal stages of FIV when the cat is unable to produce detectable antibodies. The other is during the early stages

when virus is present in the serum but antibodies have not yet been produced. In the latter case, the cat can be retested in two to three months.

False positive tests can occur in kittens who receive antibodies in the milk of an infected queen. Retest kittens 12 to 14 weeks later or after 6 months of age to determine if they are truly infected.

Treating FIV

There is currently no effective treatment for FIV virus infection. However, the massive effort to develop drugs to cure AIDS in humans involves FIV infection in cats as an animal research model. As this research progresses, it can be anticipated that effective treatment for cats may become available. Drugs used in the treatment of AIDS may provide benefit in individual cats. However, these drugs, especially AZT, are more toxic to cats than to humans. ImmunoRegulin, interferon, and acemannan have shown some benefits. Stampidine is an experimental drug that shows great promise.

It is important that the routine care of infected cats be of the highest quality: top-notch nutrition, parasite control, keeping them indoors, and minimizing stresses.

Preventing FIV

There is a vaccine available for FIV, but it is not generally recommended (see page 110). There have been problems with cats who have been vaccinated but are not truly infected testing positive for the virus. The most effective way of preventing the disease is to keep cats from roaming and fighting with infected strays. This will dramatically lower the likelihood of infection. Neutering males may reduce the incidence of fighting.

All cats in a multicat household should be tested. FIV-positive cats should be removed or isolated from contact with others. These cats should be retested using a Western blot test. Any new cat or kitten being added to your home should first be tested for FeLV and FIV.

RABIES

Rabies is a fatal disease that occurs in nearly all warm-blooded animals, although rarely in rodents. In the United States, vaccination programs for cats and other domestic animals have been remarkably effective. This has greatly reduced the risk of rabies in pets and their owners.

Ninety percent of cats with rabies are under 3 years old, and the majority are male. Rural cats are at the highest risk for rabies because of the potential for wildlife exposure.

The major wildlife reservoirs for rabies (with substantial overlap) are the skunk in the Midwest, Southwest, and California; raccoons in New England and the East; foxes in New York, neighboring eastern Canada, Alaska, and

the Southwest; and coyotes and foxes in Texas. Bats, which are distributed widely, also carry rabies.

The main source of infection for humans outside the United States continues to be a bite from an infected dog or cat. In India, for example, a country that lacks an effective rabies control program, it is estimated that several thousand people die of rabies each year. Travelers to countries where rabies is endemic should be aware of the risk of animal bites.

The rabies virus, which is present in an infected animal's saliva, usually enters the body at the site of a bite. Saliva on an open wound or mucous membrane also constitutes exposure to rabies. The incubation period in cats can be 9 days to one year, but usually signs appear within 15 to 25 days of exposure. The virus travels to the brain along nerve networks. The more distant the bite is from the brain, the longer the period of incubation. The virus then travels back along the nerves to the mouth. Entry into the salivary glands occurs less than 10 days before symptoms appear—which means animals can be infectious before they show any signs of rabies (this is unusual but possible).

Signs and symptoms of rabies are due to inflammation of the brain, called encephalitis. During the prodromal (first) stage, which lasts one to three days, signs are quite subtle and consist of personality changes. Affectionate and sociable cats often become increasingly irritable or aggressive and may bite repeatedly at the site where the virus entered the body. Shy and less outgoing cats may become overly affectionate. Soon, affected animals become withdrawn and stare off into space. They avoid light and may hide and die without ever being discovered.

There are two characteristic forms of encephalitis: the furious form and the paralytic form. A rabid cat may show signs of one or both. The furious form, or the "mad dog" type of rabies, is the most common. It lasts two to four days. A rabid cat can actually be more dangerous than a rabid dog, springing up suddenly and attacking people about the face and neck. Soon the cat develops muscle twitching, tremors, staggering, hind leg incoordination, and violent convulsions.

The paralytic form, which occurs in 30 percent of cases, causes the swallowing muscles to become paralyzed. The cat drools, coughs, and paws at his mouth. As encephalitis progresses, the cat loses control of his rear legs, collapses, and is unable to get up. Death from respiratory arrest occurs in one to two days. Because of the rapid course of rabies, paralysis may be the only sign noted.

Any cat who is bitten by an animal who is not absolutely known to be free of rabies must be assumed to have been exposed to rabies, until proven otherwise. Immediately wash out the bite wound and any saliva on the coat, taking precautions for yourself by wearing gloves.

The National Association of State Public Health Veterinarians recommends that if the cat has previously been vaccinated against rabies, revaccinate immediately and observe the cat under strict confinement indoors at home for 45 days. If the cat has not been vaccinated, either euthanize the animal or confine him under strict quarantine without direct handling by humans or contact with other animals for six months. Vaccinate him one month before he is released (that is, at five months after the bite). If this seems harsh, keep in mind that it would not have been necessary if the pet had been vaccinated. Different states may have their own specific quarantine and vaccination regulations for cats who have been exposed to rabies.

Treatment: If you or your cat are bitten by any animal of unknown rabies status, it is extremely important to vigorously cleanse all wounds and scratches, washing them thoroughly with soap and water. Studies in animals have shown that prompt local wound cleansing greatly reduces the risk of rabies. The wound should not be sutured.

Prophylaxis in a previously vaccinated cat consists of a booster shot, which should be given as soon as possible after exposure. Vaccination is not effective once signs of rabies infection appear.

The introduction of inactivated vaccines grown in human diploid cell cultures has improved the effectiveness and safety of postexposure vaccination for humans. Assuming the human bite victim did not have a pre-exposure rabies immunization, both passive rabies immune globulin and human origin active diploid cell vaccine should be given.

There is no effective treatment for rabies. Be sure your pet is properly vaccinated. It is important that cats are vaccinated only under the supervision of a veterinarian. Furthermore, a veterinarian can provide legal proof of vaccination should the need arise.

Public health considerations: Do not pet, handle or give first aid to any animal suspected of having rabies. All bites of wild animals, whether provoked or not, must be regarded as having rabies potential. If your cat is bitten by a wild animal or a domestic animal whose rabies status is unknown, wear gloves when handling your pet to clean his wounds. The saliva from the animal that is in and around the bite wound can infect a person if it gets into a cut or onto a mucous membrane.

Preventive vaccinations are available for high-risk groups of humans, including veterinarians, animal handlers, cave explorers, and laboratory workers.

Early laboratory confirmation of rabies in an animal is essential so that exposed humans can receive rabies prophylaxis as quickly as possible. The animal must be euthanized and his head sent in a chilled (not frozen) state to a laboratory equipped to diagnose rabies. Rabies is confirmed by finding rabies virus or rabies antigen in the brain or salivary tissues of the suspected animal. If the animal cannot be captured and his rabies status can't be verified, you need to consult your physician, who may suggest prophylactic vaccinations.

Whenever you have physical contact with an animal who may conceivably be rabid, *immediately consult your physician and veterinarian*, and also notify the local health department. Biting cats who have been allowed outdoors and appear healthy should be confined indoors and kept under observation for 10 days. *This is true even if the cat is known to be vaccinated for rabies*.

Fungal Diseases

Fungi are a large family that includes mushrooms. They live in soil and organic material. Many types of fungi spread via airborne spores. Fungus spores, which resist heat and can live for long periods without water, gain entrance to the body through the respiratory tract or a break in the skin.

Fungal diseases can be divided into two categories. The first are fungi that affect only the skin or mucous membranes, such as ringworm and thrush. In the second category, the fungus is widespread and involves the liver, lungs, brain, and other organs, in which case the disease is systemic.

Systemic diseases are caused by fungi that live in soil and organic material. Spores, which resist heat and can live for long periods without water, gain entrance through the respiratory system or through the skin at the site of a puncture. Systemic fungal diseases tend to occur in chronically ill or poorly nourished cats. Prolonged treatment with steroids or antibiotics may change an animal's pattern of resistance and allow a fungus infection to develop. Some cases are associated with the immune-depressant effects of feline leukemia, feline panleukopenia, or feline immunodeficiency virus.

Fungal diseases are difficult to recognize and treat. X-rays, biopsies, fungal cultures, and serologic blood tests are used to make a diagnosis. Suspect a fungus when an unexplained infection fails to respond to a full course of antibiotics. Although many systemic fungal agents can both infect humans and cats, only *Sporotrichosis* has been shown to infect humans following direct exposure to infected cats.

CRYPTOCOCCOSIS

This disease, caused by the yeastlike fungus *Cryptococcus neoformans*, is the most common systemic fungal infection of cats. It tends to occur in young adult animals. It is acquired by inhaling spores found in soil heavily contaminated by bird droppings, especially those of pigeons. The likelihood of infection is increased if the cat has an immune deficiency. However, not all cats who develop cryptococcosis are immune depressed.

The most common forms of the disease are nasal, cutaneous, and neurologic cryptococcosis. In other forms nodules, which ulcerate and drain pus, occur beneath the skin of the body.

Nasal cryptococcosis occurs in 50 percent of cases. Signs include sneezing, snuffling, a mucoid to bloody discharge from one or both nostrils, coughing, and obstructed breathing. Flesh-colored polyplike growths may protrude from the nose. The infection may extend to the brain and cause fatal meningitis with neurological signs such as circling and seizures. Ocular damage, including blindness, may also be noted.

Cutaneous cryptococcosis, which occurs in 25 percent of cases, frequently produces a firm swelling over the bridge of the nose. The face and neck are other common sites.

Neurologic cryptococcosis can show a variety of signs, depending on where the infection is located. These include blindness, seizures, and vestibular signs, such as incoordination or a head tilt. The diagnosis can be made by fungus culture or tissue *biopsy*. Often, the organisms can be identified in a smear from the nasal discharge. A cryptococcus latex agglutination test is available.

Treatment: Oral antifungal drugs of the imidazole group, such as ketoconazole, are effective when started early in the course of the disease. Fluconazole and itraconazole are newer drugs that are far better tolerated by cats. These drugs are slow acting. Treatment is prolonged. If those drugs are not successful, amphotercin B or flucytosine can be tried, but they are medications of last resort because they have many serious side effects.

Prevention: Preventing cats from hunting is helpful in preventing this disease. There are no documented cases of transmission from cats to people.

HISTOPLASMOSIS

This disease is caused by a fungus found in the central United States near the Great Lakes, the Appalachian Mountains, Texas, and the valleys of the Mississippi, Ohio, and St. Lawrence Rivers. In these areas, the nitrogen-rich soil facilitates growth of the causative fungus (*Histoplasma capsulatum*).

In the majority of cats, histoplasmosis is an insidious disease with fever, loss of appetite, weakness, weight loss, and debilitation. The liver, respiratory system, eyes, and skin may be involved. Lameness may be noted.

Cats who hunt are at risk for this problem, but cases have been documented where spores blew in a window from pigeon nests on a building. Diagnosis is made by fungal culture, needle aspirate, or tissue biopsy.

Treatment: Successful treatment with antifungal drugs, such as itraconazole, depends on early diagnosis. Despite treatment, most cats die from this infection. Mild respiratory cases have the best prognosis.

SPOROTRICHOSIS

This uncommon skin infection is caused by fungus spores in the soil. These spores usually gain access through a break in the skin. Other routes of infection

are by ingesting or inhaling spores. The disease is most common among male cats who prowl in thorny underbrush or sharp prairie grass. Most cases are reported in the northern and central portions of the United States, along river valleys and in coastal areas.

A nodule forms at the site of a skin wound, usually on the feet or legs, the face, or the base of the tail. The hair over the nodule falls out, leaving a moist, ulcerated surface. In some cases there is little surface reaction, but you may see several small firm nodules beneath the skin that appear to form a chain.

On rare occasions, the disease spreads internally to the liver and lungs. In these individuals the outlook for a cure is guarded. The diagnosis is made by removing a piece of tissue and examining it under a microscope, or more conclusively, by growing the fungus in culture. Fungal elements may also be noted in the exudates from wounds.

Treatment: The response to treatment is excellent when disease is limited to the skin and surrounding tissues. Potassium iodide was the agent of choice and is given orally. Cats must be carefully observed for any signs of iodide toxicity, however, such as vomiting, depression, twitching, and cardiac problems. Itraconazole is one of the newer antifungal drugs and is currently recommended. Amphotericin B is used to treat an internal infection, but only as a last resort. These drugs have toxic potential and require close veterinary management.

Public health considerations: Sporotrichosis has been known to infect humans who handle cats with infective drainage from nodules and ulcers. Wear rubber gloves and use strict hygienic precautions when handling cats with draining wounds. Cats can shed the organism both from the infected wounds and via their feces, so care must be taken when cleaning the litter box, as well.

ASPERGILLOSIS

This fungus is found in decaying vegetation and organic-rich soils. Aspergillosis has usually been reported in immunodeficient cats with concurrent feline panleukopenia. Nasal infection similar to that of cryptococcosis and systemic involvement like that of histoplasmosis have been described. Cats may show both pulmonary and intestinal signs.

Nasal discharge may show organisms. The nose may be quite painful and ulcerated. X-rays often show destruction of the bones and sinuses. Blood tests can help in diagnosis, including agar gel immunodiffusion (AGID) and *ELISA* tests.

Treatment: Early detection and treatment greatly increase the odds of success. Opening up the sinuses to provide direct topical treatment is the most successful treatment. Enilconazole has been used for treatment (even applied topically, much gets absorbed systemically), and the drug clotrimazole, which has been used in dogs, may work as well. Itraconazole can be tried.

BLASTOMYCOSIS

This disease is found along the Eastern seaboard, Great Lakes region, and Mississippi, Ohio, and St. Lawrence River valleys. The fungus has been isolated from cedar trees and pigeon droppings. Cats are more resistant to blastomycosis than are dogs and humans.

Most cases of blastomycosis in cats involve the respiratory system, skin, eyes, and brain. Respiratory signs are the most common and may involve coughing and labored breathing. Skin lesions in cats may involve large abscesses. The nose, face, and nail beds are common sites of such lesions. Nervous system involvement is not common in cats.

Diagnosis is established by biopsy of infected tissue or culture of infected drainage. Organisms may be identified in discharges. A variety of *serologic* tests are available.

Treatment: Itraconazole is the preferred medication and may be needed for as long as two months.

Public health considerations: The hazard to human health is minimal. However, humans have contracted blastomycosis from dog bites.

Protozoan Diseases

Protozoa are one-celled animals that are not visible to the naked eye but are easily seen under the microscope. They are usually found in water. A fresh stool specimen is required to identify the adult parasite or its cysts (called oocysts).

The life cycle of protozoans is complicated. Basically, infection results from the ingestion of the cyst form (oocyst). Cysts invade the lining of the bowel, where they mature into adult forms and are shed in the feces. Under favorable conditions they develop into the infective form.

The two most common protozoan diseases that affect cats are coccidiosis (see page 69) and toxoplasmosis (see page 67).

Rickettsial Diseases

Rickettsia are various disease-causing parasites (about the size of bacteria) that are carried by fleas, ticks, and lice. They live within cells. The majority are maintained in nature by a cycle that involves an insect vector, a permanent host, and an animal reservoir.

BARTONELLA (CAT SCRATCH DISEASE)

Once thought to be caused by a virus, the majority of cases are now believed to be caused by the rickettsial organism *Bartonella henselae*. This organism is

present in infected fleas that then feed on the cat. Bartonella usually does not make cats sick. It does, however, affect about 22,000 people each year. It is included in this chapter because of its relationship to cats and the concern surrounding its diagnosis and treatment.

The majority of human cases occur in September through January. Patients, especially children and young adults, commonly present with enlarged, tender lymph nodes of several weeks duration and of unknown cause. These patients often undergo lymph node *biopsy* to rule out lymphoma, a condition unrelated to cat scratch disease.

The cat, usually an asymptomatic carrier of the infection, is able to transmit the disease to humans indirectly via infected flea feces under the cat's nails or in his mouth from grooming. In 90 percent of cases there is a history of a cat (usually a kitten) biting, licking, or scratching the human. This suggests the infective organism is carried in the cat's mouth and may be transferred to his claws when he grooms or scratches.

Three to 10 days after exposure, a raised red sore develops in the human at the site of transmittal. This occurs in about 50 percent of cases. There may be a red streak up the arm or leg. In all cases there is tender enlargement of lymph nodes in the armpit, neck, or groin. Enlargement of the lymph nodes may persist for two to five months.

Less than 5 percent of those infected develop generalized signs, such as low-grade fever, fatigue, headache, and loss of appetite. In rare cases, there is involvement of the spleen, brain, joints, eyes, lungs, and other organs. In immunosuppressed individuals, the disease can be life-threatening.

In cats, there are usually no signs, although cats with chronic inflammatory conditions such as gingivitis, stomatitis, or inflammatory bowel disease may also have bartonellosis.

Treatment: For humans, consult your physician and follow their recommendations for diagnostic tests and treatment.

If the cat seems to show clinical illness, he can be treated with doxycycline, amoxicillin-clavulanate, or azithromycin. A major effort should be aimed at flea control (see page 138).

Prevention: Wash all cat bites and scratches promptly. Do not allow cats to lick open wounds.

There is no way to know when a particular cat harbors the infection. If one family member becomes ill following a scratch, quarantine the cat for two to three weeks to prevent him from infecting others. As a precaution, sick children and immunodeficient individuals should avoid contact with cats under 1 year of age. Routine declawing of cats to prevent human illness is not recommended. Claws can be trimmed and cats should be discouraged from rough play. Again, the emphasis should be on flea control and on treating any cat who shows clinical illness.

Antibodies and Immunity

An animal who is immune to a specific pathogen has natural substances in his system called *antibodies* that attack and destroy that pathogen before it can cause disease. Antibodies are produced by the reticuloendothelial system, which is made up of white blood cells, lymph nodes, and special cells in the bone marrow, spleen, liver, and lungs. These special cells act along with antibodies and other substances in the blood to attack and destroy pathogens.

Antibodies are highly specific. They destroy only the type of pathogen that stimulated their production. When a cat becomes ill with an infectious disease, his immune system makes antibodies against that particular pathogen. These antibodies protect the cat against reinfection. The cat has now acquired active immunity. Active immunity is self-perpetuating; the cat continues to make antibodies long after the disease has gone away. Any time the cat is exposed to that particular pathogen, his immune system will produce more antibodies. The duration of active immunity varies, depending on the pathogen and the cat. Following natural exposure, active immunity often persists for life. In general, immunity to viruses lasts longer than immunity to bacteria.

Active immunity also can be induced by vaccination. The cat is exposed to heat-killed pathogens, live or attenuated (antigens that have been treated to make them less infectious) pathogens rendered incapable of causing disease, or toxins and pathogen products that will also stimulate a response by the cat's immune system. As with natural exposure, vaccination stimulates the production of antibodies that are specific for the particular pathogen in the vaccine. However, unlike natural exposure, the duration of protection may be limited. Accordingly, to maintain high levels of protection, booster vaccines are recommended. How frequently a cat will need boosters depends on the antigen used, the number of exposures to the pathogens, the cat's own immune response, and the type of vaccination used. Vaccination schedules need to be customized for each individual cat.

Another type of immunity is called passive. Passive immunity is passed from one animal to another. The classic example is the antibodies newborn kittens absorb from the *colostrum* of their mother. Kittens are best able to absorb antibodies from their mother's milk during the first 24 to 36 hours of life. The immunity persists only as long as the antibodies remain in the kittens' circulation. The duration of immunity depends on the concentration of antibodies in maternal milk when the kittens were born. Queens vaccinated just before they were bred have the highest antibody levels and are capable of protecting kittens for up to 16 weeks. However, some veterinarians believe this additional booster is unnecessary.

Kittens younger than 3 weeks old may be incapable of developing antibodies in response to vaccination because of physical immaturity or interference by passive maternally acquired antibodies. Maternal antibodies can bind the antigen in the vaccine and keep it from stimulating the immune system. These passive antibodies disappear at between 6 and 16 weeks of age. Therefore, when vaccinating very young kittens, the vaccine must be given more frequently to ensure that the vaccine will stimulate immunity as soon as maternal antibody levels decline and can no longer interfere with the vaccine.

Another source of passive immunity can occur with a transfusion of blood products with antibodies into a cat with a serious infection or immune problem. This is not done frequently, but can be a life-saver for some cats.

Vaccinations

There are several types of vaccines currently available for use in cats: modified live virus (MLV), inactivated or killed virus, and the newest recombinant technologies—live vectored, subunit, and DNA vaccines. Modified live virus vaccines are vaccines that contain virus that is alive and that will replicate when in a cat, but that has been modified so it shouldn't cause the actual disease. These vaccines tend to generate a quick and full immune response. Modified live vaccines are more effective and produce longer-lasting immunity than do killed vaccines.

Killed virus vaccines are vaccines with dead virus, which will not replicate in a cat, so they are incapable of causing disease. Instead, they rely on surface antigens, along with immunity stimulants called adjuvants, to stimulate an immune response.

Recombinant vaccines are among the newest products in the rapidly emerging biotechnology market. The technology relies on the ability to splice gene-size fragments of DNA from one organism (a virus or bacteria) and to deliver these fragments to another organism (the cat), where they stimulate the production of antibodies.

For the live vectored version, genes from a feline *antigen* may be put into a noninfectious virus. Antibodies are stimulated; there is no replication of the antigen. Subunit vaccines stimulate immunity to a part of the antigen of an infectious organism. These are set up to provide the most immunity for the least amount of antigen used. With DNA vaccines—currently experimental for cats—only a small amount of DNA from the infectious agent is used.

Thus, recombinant vaccines deliver specific antigen material on a cellular level without the risk of vaccination reactions associated with giving the entire disease-causing organism. This represents a truly new development. It is expected that recombinant vaccines will soon replace MLVs and whole killed vaccines for many, if not most, feline infectious diseases.

Results for recombinant vaccines indicate that immunity can last as long as with MLVs. With all types of vaccines, booster shots are necessary to maintain an adequate level of protection. The frequency of needed booster shots varies, depending on the disease involved, the individual vaccine, the cat's own immune system, and whether he has been exposed to the disease agent naturally.

Various technologies are available for giving vaccines to cats. Vaccines may be injected under the skin (subcutaneously, or SC) or into a muscle (intramuscularly, or IM). Drops may be put into the nose and/or eyes, and a new transdermal version of some vaccines is absorbed through the skin.

WHY VACCINES FAIL

Vaccines are highly effective in preventing certain infectious diseases in cats, but failures do occur. They can be due to improper handling and storage, incorrect administration, or inability of the cat to respond to the vaccine because of a run-down condition or concurrent illness that stresses his immune system. Giving too many vaccinations at the same time or too frequently can cause immune system overload and a failure to produce antibodies. If a cat is already infected, vaccinating him will not alter the course of the disease. Stretching out the vaccine by dividing a single dose between two cats is another reason a vaccine may not be effective.

Because each cat is an individual, proper handling and administration of the vaccine is important. Vaccinations should be given only by those familiar with the technique.

Vaccinations may not be successful in all cats. Run-down, malnourished, debilitated cats may not be capable of responding to a disease challenge by developing antibodies or building immunity. Such cats should not be vaccinated at that time, but should be vaccinated when they're in better health. Immunosuppressive drugs, such as cortisone and chemotherapy agents, depress the immune system and also prevent the body from making antibodies.

Between 6 and 16 weeks of age, there is a window of risk during which a kitten's passive antibodies (ingested from the mother's milk) are no longer fully protective, but may yet interfere with the vaccination process. For this reason, nursing kittens should not be vaccinated before 6 weeks of age and should not complete their vaccination series before 16 weeks of age.

Young kittens are highly susceptible to certain infectious diseases and should be vaccinated against them as soon as they are old enough to build an immunity. These diseases are panleukopenia, feline viral respiratory disease complex, possibly feline leukemia, and rabies. Vaccines against feline infectious peritonitis, ringworm, giardia, feline immunodeficiency virus, and feline pneumonitis (chlamydia infection) are available and may be indicated in special situations.

To be effective, vaccinations must be kept current (see *Vaccination Recommendations*, page 111).

Allergic reactions in cats tend to be vomiting, with or without diarrhea, difficulty breathing, and itching and hives. Collapse can follow if no action is taken. This is a good reason to have vaccinations done at the veterinary hospital, where care is readily available.

Cats who have had mild vaccine reactions may benefit from a prophylactic dose of an antihistamine or corticosteroid prior to the vaccination. The cat should remain at the veterinary hospital for a short time after vaccination to be sure there will be no reaction.

THE REVACCINATION DEBATE

A subject of much debate in the field of immunology is the timing of booster injections. Based on a growing body of evidence, recommendations for booster vaccinations have been changing. In general, viral vaccines tend to stimulate longer immunity than bacterial vaccines.

It is now believed that the protective response to vaccines for viruses probably persists for several years following a vaccination series and that booster shots can be given every three years instead of every year. This interval for booster shots may be extended even longer with the newer vaccines and updated research on the duration of immunity.

The best way to manage vaccinations is to work with your veterinarian to develop a customized vaccination schedule for your cat, based on your own cat's health and risk factors.

COMBINATION VACCINES

Many feline vaccines are combination or multivalent vaccines. This means a vaccine includes antigens for several diseases all in one injection. At one time, vaccines had as many as five disease antigens included in one injection. It is now believed that less is better—both because some vaccines simply aren't necessary for all cats and because you don't want to overwhelm a cat's immune system.

The most common combination vaccines currently are FVR, FCV, and FPL for rhinotracheitis (herpes), calicivirus, and feline panleukopenia. Most veterinarians use these minimal multivalent vaccines.

For cats who have had—or are at risk for—vaccine reactions, the core vaccines, such as calicivirus, rhinotracheitis, and panleukopenia, may be given separately and only boostered as indicated by titers. (Titers measure the immunity present in a cat's system, but more research is needed to determine exactly what minimum titer levels indicate a cat is safe from disease.)

CORE AND NONCORE VACCINES

The veterinary community has divided vaccines into two main categories, with a smaller third category. Core vaccines are vaccines that every cat should have at some time in his life. Noncore vaccines are vaccines that only some cats need, depending on factors such as geographic location and lifestyle. Other vaccines are also available but are generally not recommended for any cats.

VACCINE-ASSOCIATED FELINE SARCOMA

An association between vaccine administration and sarcoma development has been established in cats. Feline leukemia and rabies virus vaccines have more frequently been implicated in sarcoma development than have other vaccines. Both subcutaneous and intramuscular sites have been affected. See *Vaccine-Associated Feline Sarcoma*, page 530, for more information.

Due to concerns about adjuvants and inflammatory response leading to the cancers, the American Association of Feline Practitioners, together with other veterinary organizations, has established new guidelines for vaccinations. These guidelines include injection site recommendations that make it easier to track any problems that develop, and to treat any cancer that might develop. Recommended sites are right rear limb for rabies, left rear limb for feline leukemia, and right shoulder, off the midline, for any other subcutaneous vaccinations.

Available Vaccines

Young kittens are highly susceptible to certain infectious diseases and should be vaccinated against them as soon as they are old enough to build immunity. The American Association of Feline Practitioners has drawn up guidelines categorizing vaccines as core, noncore, or not recommended, and these categories will be indicated for all the vaccines described in this section. While these guidelines suggest that kittens as young as 6 weeks may be vaccinated, most veterinarians and breeders wait until 7 or 8 weeks of age. Also, vaccine recommendations state that many vaccines do not need boosters beyond 12 weeks of age, but veterinarians, particularly in endemic disease areas, may do a final kitten vaccine at about 16 weeks.

PANLEUKOPENIA (CORE)

The first panleukopenia (FPV) shot should be given at 6 to 8 weeks of age, before a kitten is placed in a new home where he may be exposed to other cats. If the kitten is at particular risk in an area where the disease has

occurred, vaccination can be given at 6 weeks of age and then every three to four weeks until the kitten is 16 weeks old. Discuss this with your veterinarian.

After the initial kitten series, a booster given at 1 to 2 years of age may be sufficient in cats who mix with others, because exposure to the disease boosts immunity. A booster after one year is recommended, and then no more frequently than every three years.

Two types of injectable vaccines are available. One is a killed virus and one is a modified live strain. An intranasal vaccine is also available. The modified live virus vaccine is not recommended for pregnant cats or kittens younger than 4 weeks. Killed virus vaccines may be more appropriate in disease-free colonies because there is no risk of reversion to virulence.

Panleukopenia vaccine is often combined with the feline viral respiratory disease complex vaccines and given as a single injection.

FELINE VIRAL RESPIRATORY DISEASE COMPLEX (CORE)

Your veterinarian may recommend an injectable vaccine containing strains of the herpesvirus (FHV) and calicivirus (FCV). Usually, they are combined with panleukopenia vaccine and given at least twice as a single injection, with the last vaccination not before 16 weeks of age. Kittens may be vaccinated as early as 6 weeks of age.

Adolescent and adult cats should receive two initial doses, administered three to four weeks apart. In both kittens and adults, a booster after one year is recommended, and then every three years.

Although viral respiratory disease vaccines are highly effective, they do not prevent all cases of illness. The cat can be exposed to individual strains of virus that are not countered by the vaccine, or the infection can be so severe that it overcomes the cat's protection against it. When this happens, the resulting disease usually is milder than it would be in an unvaccinated cat. Vaccination will not prevent carrier states in cats who do become infected.

Vaccines for the respiratory viruses are available as injectable modified live virus, injectable killed virus, and modified live intranasal. The intranasal route may produce sneezing and nasal discharge. The killed virus vaccine is preferred for pregnant queens and in disease-free colonies because there is no risk of reversion to virulence.

Virulent Systemic Feline Calicivirus

A new vaccine, CaliciVax, was recently introduced to combat virulent systemic feline calicivirus. It is an adjuvanted killed virus. CaliciVax contains a VS-FCV strain, as well as the older strain of FCV. It is labeled for injection in healthy cats 8 to 10 weeks of age, with a second dose in three to four weeks and annual boosters thereafter. However, the risks of using an adjuvanted vaccine

(see *Vaccine-Associated Feline Sarcoma*, page 530) may not be worth it, unless VS-FCV has been confirmed in your area.

This vaccine was introduced in 2007, after the most recent AAFP vaccination guidelines were issued. Its ultimate efficacy will be proved only with widespread, long-term use.

RABIES (CORE)

State and city statutes establish requirements for rabies vaccinations. All rabies vaccinations should be administered by a veterinarian, and in many states this is the law. A cat being shipped across some state lines must have a current rabies vaccination, and a certificate attesting to that fact must accompany the cat.

There are three types of rabies vaccines available: These include recombinant, nonadjuvanted canary pox vectored, and killed adjuvanted. All of them are injectable. In general, it is recommended that kittens receive a single dose of killed or recombinant rabies vaccine at 8 or 12 weeks of age, depending on the vaccine used. Adult cats with unknown vaccination history should also receive a single dose of killed or recombinant rabies vaccine. For the recombinant vaccines, boosters are recommended annually. For the killed rabies vaccines, a booster is required at one year, and thereafter, three years using a vaccine approved for three-year administration.

According to recommendations of the Vaccine-Associated Sarcoma Task Force, rabies vaccines are administered subcutaneously as distally as possible in the right rear limb.

FELINE LEUKEMIA VIRUS (NONCORE)

The development of a vaccine against retroviral infection is a long-awaited achievement in veterinary medicine. However, this vaccine is not 100 percent effective. It is possible that some cats vaccinated for FeLV may still become infected.

This vaccine is noncore because of its incomplete effectiveness and because indoor cats who have been tested before coming home should have minimal risk of acquiring FeLV and therefore should not need this vaccine. Kittens born to immune queens acquire protective antibodies in the *colostrum* of the queen. This protection begins to disappear at 6 to 12 weeks of age, after which kittens are susceptible.

Cats with access to the outdoors or who roam free may need this vaccine. However, since kittens are most susceptible to FeLV and may escape, some veterinarians recommend vaccinating kittens and giving a first booster at 1 year. If the cat is then firmly established as an indoor-only cat, no more boosters are needed.

Testing for FeLV is recommended before vaccination. Vaccination is not effective if the cat is positive and already infected. If the *ELISA* test is negative, vaccinate kittens at 8 to 12 weeks of age and again at 14 or 16 weeks. The first booster is given one year later.

To be effective, a full course of vaccination must be administered. This involves two vaccinations two to three weeks apart, a booster a year later, and then annual boosters, if needed.

Vaccines available include injectable adjuvanted killed virus, nonadjuvanted recombinant for transdermal use, and, in Europe, a nonadjuvanted recombinant for subcutaneous injection. According to recommendations of the Vaccine-Associated Sarcoma Task Force, FeLV vaccines are administered subcutaneously as distally as possible in the left rear limb.

FELINE IMMUNODEFICIENCY VIRUS (NONCORE)

The FIV vaccine is an inactivated, killed, injectable vaccine. Unfortunately, vaccination of FIV-negative cats causes the *serologic* tests that are currently available to read as positive. In addition, previous vaccination does not rule out infection, so the significance of a positive test result in a vaccinated cat cannot be assessed. There is concern that the subtype of virus used in the vaccine may not protect against the more common subtypes of the disease. Therefore, the risks and benefits of the use of this vaccine should be carefully discussed with your veterinarian.

CHLAMYDOPHILA FELIS (NONCORE)

Chlamydophila felis causes feline pneumonitis in cats. Immunity induced by vaccination is probably of short duration and the vaccine provides only incomplete protection. Vaccinated cats can still come down with pneumonitis but usually have a shorter, milder illness. The use of this vaccine could be considered for a cat entering a population of cats where infection is known to be endemic. However, the vaccine has been associated with adverse reactions in 3 percent of vaccinated cats.

BORDETELLA BRONCHISEPTICA (NONCORE)

This is a modified live intranasal vaccine. *Bordetella bronchiseptica* is primarily a problem of very young kittens, where it can cause severe lower respiratory tract disease. It appears to be uncommon in adult cats and pet cats in general, and should respond readily to antibiotics, so vaccination is generally not recommended.

FELINE INFECTIOUS PERITONITIS (NOT RECOMMENDED)

The FIP vaccine is an intranasal modified live virus product. The efficacy of this vaccine is controversial, and duration of immunity is short. Although exposure to feline coronaviruses in the cat population is high, the incidence of FIP is very low, especially in single-cat households. Most cats in cattery situations where FIP is a problem become infected with coronaviruses prior to 16 weeks of age, which is the age at which vaccination is first recommended.

GIARDIA LAMBLIA (NOT RECOMMENDED)

This is a killed, injectable vaccine. It is not recommended because the disease is easy to treat and because there is not enough evidence to support the role of the vaccine in preventing disease.

Vaccination Recommendations

This chart is based on the recommendations of the American Association of Feline Practitioners 2006 Vaccine Guidelines. An individual vaccine schedule should be customized for each cat. Booster recommendations are changing frequently, with longer intervals becoming more common.

	Kitten Vaccines	Boosters
CORE VACCINES *These vaccines are recommended for all cats*		
Rabies Required by law	1 dose at 2 to 4 months of age, depending on the vaccine	1 year later, then annually or every 3 years, as per vaccine labeling and as required by local law
Panleukopenia (FPV) Important for every cat	First given at 6 to 8 weeks of age, then every 3 to 4 weeks until 16 weeks of age	At 1 year following the last dose, then no more often than every 3 years
Feline Herpesvirus (FHV) Important for every cat	First given at 6 to 8 weeks of age, then every 3 to 4 weeks until 16 weeks of age	At 1 year following the last dose, then every 3 years
Feline Calicivirus (FCV) Important for every cat	First given at 6 to 8 weeks of age, then every 3 to 4 weeks until 16 weeks of age	At 1 year following the last dose, then no more often than every 3 years

continued

Vaccination Recommendations *(continued)*

	Kitten Vaccines	Boosters
NONCORE VACCINES *Depending on individual circumstances, these vaccines may or may not be important for your cat*		
Feline Leukemia Virus (FeLV)	1 dose at 8 weeks of age, then 1 dose 3 to 4 weeks later	At 1 year following the last dose, then annually in cats with sustained risk
Feline Immunodeficiency Virus (FIV)	First given at 8 weeks of age, then 2 more doses at 2- to 3-week intervals	At 1 year following the last dose, then annually in cats with sustained risk
Bordetella bronchiseptica	1 dose at 8 weeks of age	Annually in cats with sustained risk
Chlamydophila felis	1 dose at 9 weeks of age then a second dose 3 to 4 weeks later	Annually in cats with sustained risk
NOT GENERALLY RECOMMENDED These vaccines are not recommended due to mild disease and/or inadequate efficacy		
Feline Infectious Peritonitis (FIP)		
Giardia lamblia		

Shelter Recommendations

For cats in high-risk situations such as shelters, the vaccination schedule may need to be adjusted. Kittens should get a feline panleukopenia vaccination as soon as they enter a shelter—even as early as 4 to 6 weeks of age. Boosters can be administered every two weeks until they are 16 weeks of age.

The same holds true for rhinotracheitis (herpes) and calicivirus vaccinations. Rabies should be given as early as possible (12 weeks of age, generally) and then a booster should be given at one year. For older cats, a rabies vaccine should be given as soon as they enter the shelter, unless they are under quarantine.

It is also recommended that all kittens and cats be tested for FeLV and FIV. Those who test positive should be isolated and retested, unless they are clinically ill.