The most important infectious diseases affecting dogs are canine distemper, infectious canine hepatitis, leptospirosis, parvovirus infection, kennel cough, and rabies. Other infectious diseases that affect dogs do not occur as frequently.

**Canine Distemper**

Canine distemper is a severe, highly contagious, worldwide viral disease of dogs and other carnivores. It is caused by a virus closely related to but not the same as measles virus. All forms of the disease are caused by the same virus but the duration and type of diseases produced by different canine distemper strains vary greatly.

In the early stages it is characterized by discharges from eyes and nose and signs referable to digestive and respiratory involvement. In later stages there are signs referable to nervous system involvement.

The disease's incidence is highest in young dogs, but susceptible dogs of all ages may become infected. Young dogs become susceptible to canine distemper when they lose colostral antibody, usually between 6 and 12 weeks of age. Young dogs between 3 and 6 months of age are affected most often by the disease.

Infection of susceptible animals usually occurs by inhalation of airborne organisms, and the virus spreads throughout the body. These animals develop fever, depression, eye and nose discharges, and coughing. Diarrhea and
occasional vomiting frequently occur simultaneously.

The animal’s condition deteriorates with accompanying weight loss and dehydration. Animals eventually become moribund with or without nervous system signs.

Some dogs may show improvement after the first signs are seen, but weeks or months later develop nervous system disturbances that terminate in death or lifelong impairment of the nervous system.

**Chewing Gum Fit.** Convulsions, chomping the jaws (chewing gum fit), incoordination, pacing, circling, and psychic changes are common in early disease states. Rhythmic movements of the jaws, ears, or legs, caused by twitching muscles and usually called chorea, may occur after other signs subside. Blindness, hardpad disease, and reproductive failures are other problems that can occur because of canine distemper.

With the use of vaccines and antibiotics, canine distemper disease has changed. Use of vaccines has controlled viral strains that induce early disease better than strains causing delayed disease. Use of antibiotics has reduced the incidence of digestive and respiratory involvement due to bacterial infections that accompany the viral infection.

Diagnosis can be difficult to make in dogs that have a delayed form. Laboratory tests, such as fluorescent antibody tests, virus isolation and neutralization test, frequently are required to diagnose canine distemper.

**Immunization** is the preferred method of preventing canine distemper. Potent and safe modified live-virus vaccines are available and induce good immunity in dogs.

Because colostral antibody interferes with vaccination, dogs should be vaccinated repeatedly. In most cases, 3 vaccinations are given, at 8 weeks, 12 weeks, and 16 weeks of age.

Because of antibody loss, vaccinated dogs can develop canine distemper several years later after receiving vaccinations as puppies. Annual revaccinations throughout the dog’s life are recommended because of loss of their antibody protection.

**Infectious Canine Hepatitis** also is a severe, highly contagious, viral disease of dogs. It is caused by an adenovirus and is related to the large group of adenoviruses that cause a variety of diseases in humans and lower animals.

The virus that causes in-
 Infectious canine hepatitis is not infectious for people. The virus is spread from dog to dog through the urine, and a dog may shed the virus from the kidneys in the urine for long periods of time after apparent recovery. Infection usually is acquired by contact of infective material such as urine or saliva in the mouth.

This disease is seen most frequently in young dogs, but can be seen in all ages of dogs. The affected animal becomes apathetic and loses its appetite and may frequently have an intense thirst. At this time the body temperature increases and swelling of the head, neck, and lower portion of the abdomen may occur.

Vomiting and diarrhea are common. Many animals manifest pain by moaning, especially when pressure is brought to bear on the abdominal wall.

Only rarely does jaundice occur. The gums usually are pale and sometimes hemorrhages appear on them. The tonsils frequently are enlarged and painful.

Progression of this disease is much more rapid than distemper. Most dogs have either recovered or are dead within 2 weeks. Many die within a few days.

Tests, Vaccines. Infectious canine hepatitis must be differentiated from canine distemper, leptospirosis, parvovirus infection, and the effects of certain poisons. Diagnosis is especially difficult in young puppies. Results of laboratory tests reflecting damage to liver and kidneys strengthen a presumptive diagnosis which has been based on history and physical examination.

Specific diagnosis depends on demonstration of the virus in blood or liver tissue. This is accomplished by using fluorescent antibody test or virus isolation in liver cell cultures.

Recovery from infectious canine hepatitis produces a long-lasting immunity.

Modified live-virus vaccine is mostly used for immunization. Vaccination will be ineffective until the puppy has lost essentially all of its colostral antibody.

Products currently available for immunization against infectious canine hepatitis are usually combined with canine distemper virus.

Blue Eye. The first modified live-virus vaccine for infectious canine hepatitis contained the virus called adenovirus-1 which occasionally caused an immune-mediated "blue eye" condition. The eye problem would disap-
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pear spontaneously and did not cause damage if managed conservatively.

Recently a modified live-virus called adenovirus-2 was approved to replace canine adenovirus-1 in vaccines and the "blue eye" condition is no longer a problem. This modification has been very helpful in improving the protection against infectious canine hepatitis.

Vaccination of puppies is given at the same time as canine distemper, 8 weeks, 12 weeks, and 16 weeks. Annual revaccination is also recommended for dogs of all ages.

**Leptospirosis**
This disease of dogs is caused by *Leptospira canicola* and *Leptospira icterohemorrhagiae*. Leptospirosis is significant from a public health aspect because dogs and other animals can act as reservoirs for human infections.

Leptospira organisms are easily killed by heat and disinfectants. They will survive for long periods outside the body in water or sewage. Alkalinity of urine or water favors their survival, and acidity will cause their death within a few hours.

Infected animals, such as wild rodents and livestock, can contaminate food and water. The most common method of spread is thought to be direct contact or ingestion of contaminated food and water.

**Outbreaks** have occurred in humans and dogs after floods, or after swimming in or drinking water contaminated by urine of rodents or other animals. Leptospira organisms enter the body through abrasions in the skin or mucous membranes.

Animals may carry the organisms and shed them in the urine for months or years after apparent recovery from the disease.

**Signs** of leptospirosis in dogs are quite varied in severity depending on an individual animal’s response to the infection. The onset of signs generally is sudden with high fever, not eating, vomiting, and diarrhea. Dehydration and depression result if the preceding signs are severe.

Reddening of the membranes of the eyes and mouth is common. Jaundice usually occurs with infection caused by *Leptospira icterohemorrhagiae*.

Pain in the abdomen is evident when liver, kidney or gastrointestinal tract is severely affected. Ulcers in the mouth are seen in animals that develop kidney failure.
A positive diagnosis of leptospirosis is based on finding organisms in the urine or blood with a history of liver and kidney disease. Demonstration of a rising leptospira titer in paired blood serum samples when taken at least one week apart is evidence of active infection.

**Antibiotics** are very effective for treating leptospirosis in dogs.

Owners of infected dogs should be aware of the potential health hazard and efforts should be made to determine the source of the infection.

Death occurs frequently from severe damage to the liver and kidneys.

Leptospiral vaccine is available and effective in preventing the disease in dogs. Animals should be vaccinated for leptospirosis when they receive their distemper-hepatitis vaccine. Annual revaccination is recommended for effective immunity.

**Canine Parvovirus Infection** is a relatively new disease of dogs, which was first described in 1977. The disease is caused by a small DNA-containing virus that requires rapidly dividing cells for its growth to occur in the body. Therefore young, rapidly growing dogs are most susceptible to severe disease.

Susceptible dogs are rapidly infected and canine parvovirus is very contagious. The main source of infection is ingestion of materials contaminated with feces from infected dogs.

**Two Forms of Disease.** There are two distinct forms of the disease. One involves the intestines and the other the heart.

Severity of the disease depends primarily on the age and immune status of the dog. The most severe and often fatal disease occurs in puppies less than 12 weeks old.

In the *intestinal* form the parvovirus grows in epithelial cells of the small intestine and rapidly destroys them.

Young dogs are affected initially by vomiting followed by diarrhea, refusal to eat, and severe dehydration. The feces appear yellow-gray and often are streaked or darkened by blood. Elevated body temperature and a decrease in white blood cell numbers are usually present in severe cases.

Recovery from the infection may be complicated by additional problems such as bacteria, parasites, or other viruses.

Young puppies less than 8 weeks old may suffer severe heart problems due to virus
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damage. The heart enlarges, leading to severe circulatory malfunction and heart failure.

The Heart Form of the disease may be preceded by the intestinal form or may occur suddenly without apparent previous disease. Although the infection of the heart may occur at 6 to 8 weeks of age the dog may not experience heart failure until 6 to 9 months of age in some cases.

Fresh feces taken from affected animals early in the course of intestinal disease may contain large numbers of virus particles. These can be identified by electron microscopic examination of the feces or by performing other laboratory tests on them. Virus identification or isolation accompanying the history and physical examination usually is diagnostic for the disease.

Diagnosis of the heart form of this disease generally is based entirely on the history of heart disease confirmed by physical examination.

An effective immunization program is the key to controlling canine parvovirus infection. Safe and effective killed-virus and modified live-virus vaccines are commercially available for use in dogs. Dogs should be vaccinated for canine parvovirus infection when they receive their distemper-hepatitis-leptospirosis vaccine. Annual revaccination is recommended for effective immunity.

Kennel Cough

Any contagious respiratory disease of dogs that is manifested by coughing and not caused by canine distemper is often referred to as kennel cough.

The disease is more accurately called infectious tracheo-bronchitis and is defined as an infectious respiratory disease of dogs marked by coughing and in some cases by fever, not eating, and pneumonia. It is caused by various viruses and/or bacteria alone or in combination.

The viruses most frequently incriminated as causes of kennel cough are canine distemper virus, canine adenovirus-2, and canine parainfluenza virus. Many different bacteria have been incriminated as causing signs of kennel cough but *Bordetella bronchiseptica* can produce signs that are indistinguishable from those of virus-caused kennel cough.

Kennel cough occurs primarily when dogs of varying ages and susceptibility are congregated under less than
When you have to kennel your dog, make sure the kennel you choose is clean and well-managed.

ideal hygienic conditions.

Animals taken immediately from pet shops, animal shelters, animal control facilities, and boarding and training kennels are more likely to experience kennel cough. The kennel cough agents are quickly spread when an infected dog coughs.

The most prominent sign of disease is a cough. Except for the cough, a dog usually appears to be healthy. The cough is mostly dry and hacking and followed by gagging or expectoration of mucus. Excitement, exercise, drastic changes in weather, or even gentle pressure on the trachea will induce episodes of coughing.

Shedding of the kennel cough organisms in respiratory secretions of dogs that are asymptomatic accounts for the persistence of these infections in dog kennels, animal control facilities and boarding facilities. Most dogs with kennel cough infections are older than 6 months of age.

Puppies Hard Hit. The most severe form of kennel cough is seen in dogs that are 6 weeks to 6 months of age. Animals seen in this age range generally are not vaccinated and have a fever and lack of appetite.

In this form the cough is less apparent and if present is moist. Coughing may be so painful that the animal attempts to suppress it. This form of kennel cough progresses rapidly into pneumonia.

It is extremely difficult to distinguish the signs of this
form of kennel cough from those of canine distemper. Many cases originally diagnosed as severe kennel cough prove to be canine distemper and vice versa.

**Diagnosis** of kennel cough is difficult and usually based on the history and physical examination. It is established by eliminating other possible causes of coughing.

Viral and bacterial vaccines now are available to control the principal agents involved in kennel cough. Combination vaccines are available to use against canine distemper, canine adenovirus-2, canine parainfluenza, and *Bordetella bronchiseptica* infections in dogs.

Dogs should be vaccinated for kennel cough when they receive their early puppy immunizations. Annual revaccination is recommended for effective protection against kennel cough.

**Coronavirus**

**Canine Enteric Coronavirus Infections.** In 1971 a canine coronavirus was isolated from feces of military dogs that were suffering from severe vomiting and diarrhea. This is known to cause a highly contagious viral disease that spreads rapidly from infected dogs to susceptible dogs by way of contaminated feces.

Animals usually experience a sudden onset of diarrhea preceded at times by vomiting. The feces generally is orange in color, very malodorous, and infrequently contains blood.

Inactivity and loss of appetite are common signs accompanying the diarrhea. Elevation in body temperature is infrequent.

When complicating factors such as parasites, bacteria, or other viruses are present, the disease can be significantly prolonged.

Diagnosis usually is based on the history and physical examination and the identification of coronavirus by electron microscopic examination of feces or by performing other laboratory tests on the feces. At the present time an acceptable vaccine is not available for immunization.

**Canine Brucellosis**

This may be caused by bacterial species of the genus *Brucella*; however, the most common in the dog is *Brucella canis*. Brucellosis occurs worldwide and *Brucella canis* has been reported in nearly all States in the United States.

Infection can occur readily across all mucous mem-
branes. The oral and venereal routes are the most common. Transmission occurs readily when an uninfected bitch in heat is mated to an infected male. Similarly, males may acquire the infection from infected females in heat.

The organism can be isolated from urine of infected dogs, but urine does not appear to be an important factor in natural spread of the disease.

Semen from infected males contains the organism for long periods of time presumably due to persistent infection in the prostate and epididymal tissues. Materials aborted by an infected female will contain large numbers of organisms which contaminates the environment around the animal.

**Human Infections** have occurred in owners of infected dogs. Owners of infected animals should be aware that the disease can occur in people and they are at risk being around the animal.

Diagnosis of canine brucellosis cannot be established by physical examination alone. In general, dogs with canine brucellosis are not seriously ill, and deaths of adult dogs due to *Brucella canis* infection have not occurred.

**What to Look for.** One is alerted to brucellosis by sudden abortion by an otherwise healthy bitch, failure to conceive after breeding, and alteration in size of the male genitalia. In rare cases the organism can cause damage to the spine and causes extreme pain and neurological problems in the rear legs.

Diagnosis may be suspected on historical information but should be confirmed on demonstration of specific antibodies in the dog's blood. Attempts to isolate *Brucella canis* from the blood, semen, or vaginal discharge from suspected animals should be done.

The potential of canine brucellosis being transmitted to people should be considered when contemplating treatment. Currently dogs are treated with antibiotics for canine brucellosis with some success.

Treatment must be evaluated by attempts to isolate *Brucella canis* from blood and specific antibody tests performed 6 to 8 weeks after cessation of therapy. Additionally, infected animals should be castrated or spayed in order to reduce spread of the disease through breeding.

**No vaccine** currently is available against canine brucellosis.
Because of the devastating effect of brucellosis on the reproductive usefulness of infected dogs, breeders should be strongly encouraged to mate their dogs only to animals which have been proven brucellosis free. Prebreeding examination for any bitch or stud should be required.

Rickettsial Diseases
These diseases in dogs vary in occurrence according to the availability of the reservoir and vector of the organism. Canine ehrlichiosis, Salmon disease, Elokomin fluke fever, and Rocky Mountain spotted fever are all diseases caused by rickettsial organisms. Canine ehrlichiosis is caused by infection with Ehrlichia canis.

Ehrlichia canis is transmitted to dogs by bites of the brown dog tick, Rhipicephalus sanguineus.

Salmon disease refers to the disease of dogs resulting from ingestion of raw salmon, trout, lampreys, sculpins, and redside shiners that carry rickettsial-infected flukes. Elokomin fluke fever is another fluke-transmitted rickettsial disease which occurs when dogs ingest raw salmon infected with rickettsial-infected flukes.

The term "fluke" applies to a large group of internal parasites of animals and man. They infest various parts of the body, and like insects can transmit certain diseases.

Canine Rocky Mountain spotted fever is caused by infection with Rickettsia rickettsii. The Rickettsia rickettsii is transmitted to dogs by bites of an infected American dog tick, American wood tick, or brown dog tick. Reservoirs and vectors of the rickettsial disease have to be present in a region for the disease to occur.

Signs of rickettsial disease may vary among dogs but usually include high fever, decreased appetite, and depression. Enlarged lymph nodes frequently are detected.

Dehydration, weight loss, and swelling of the legs and lower portion of the abdomen may occur. Hemorrhages also may be seen on membranes of the mouth and nonpigmented skin.

When death occurs, it usually is due to uncontrolled bleeding or secondary infection resulting from low white blood cell numbers.

Recovery from rickettsial disease in dogs is invariably accompanied by persistent relapses with the organisms unless appropriate antibiotic therapy is given.

The rickettsial diseases in general are very responsive to
antibiotic therapy. Diagnosis is usually suspected through a medical history and confirmed by identification of the organism in blood or tissue cells or specific antibody tests.

**Canine Babesiosis**
This is caused by the infection with *Babesia canis*, which is prevalent in dogs in the southern United States but has been reported in other parts of the country.

The organism is a one cell animal parasite that usually occurs inside the red blood cells. Common dog ticks transmit the organism from infected dog to a susceptible dog.

Signs of an infection are characterized by fever along with increased pulse and respiration rates. A progressive decrease in red blood cells and jaundice are frequently seen.

Diagnosis of babesiosis is usually based on the history and physical examination along with identification of the red blood cell-laden organisms and specific antibody tests.

**Tetanus** in dogs is caused by the bacterium, *Clostridium tetani*, whose spores are present in the soil and the feces of various animals.

Most cases of tetanus result from contamination of small puncture wounds and lacerations with the organism from soil or feces. The organism produces toxins that cause the nervous system of the dog to be overstimulated.

The dog experiences spasms of facial muscles that lead to abnormal expressions, erect carriage of the ears, and wrinkling of the skin of the forehead. Spasticity, lockjaw, inability to stand, prolapse of third eyelids, and overextended head, neck, and legs may be seen as the disease progresses. Hypersensitivity to external stimuli occurs in severe cases.

Death usually occurs as a result of failure of the muscles of respiration or other complications that develop during the illness’ course.

Regular immunization for protection of dogs against tetanus usually is not recommended.

**Botulism** in dogs results from ingestion of a toxin produced by the bacterium *Clostridium botulinum*. Animals usually acquire the toxin by ingesting contaminated material such as rotting carcasses or garbage.

Signs of botulism result from the paralyzing effects of the toxin at junctions of the muscles and nerves. The onset is sudden and the animal usu-
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An animal loses normal muscle function with total flaccid paralysis.

Diagnosis of botulism usually is based on history of exposure to contaminated material, and physical examination.

**Canine Herpesvirus**

This infection causes severe illness and death only in puppies less than 6 weeks old. The agent is a DNA virus and only dogs are known to be susceptible.

Spread of the disease is by direct contact between infected and susceptible dogs. Infected adult dogs may shed virus in oral, nasal, and vaginal secretions for as long as 2 weeks following infection.

Because of the suckling behavior of puppies, a single infected puppy in a litter may readily transfer the infection by way of saliva, feces, and urine to susceptible littermates.

Unborn puppies may be infected in the mother's womb by primary infection of the mother or during passage through the birth canal of the recently exposed bitch.

Illness in young puppies usually occurs between the 5th and 18th day after birth. Signs of illness in puppies are change in the color of feces, difficulty in breathing, abdominal pain, ceasing to nurse and constant crying. Affected puppies usually die shortly after the onset of signs of disease.

Adult dogs show no real signs of illness during primary infection.

Diagnosis of canine herpesvirus infection usually is based on microscopic examination of tissues taken from dead puppies and by isolating the virus. No vaccines are available for this disease.

**Pseudorabies** is caused by infection with DNA virus. The disease is seen in areas where dogs are in daily contact with infected swine.

Dogs experience sudden onset of nervous system derangement manifested by intense itching. Self-mutilation is a prominent feature of the disease by the dog's attempt to relieve itching.

The disease progresses to convulsions and paralysis and the dogs die in a coma within 24 to 72 hours.

Diagnosis of canine pseudorabies is based on the history and physical examination. At the present time the low incidence of the disease in dogs in this country has not warranted routine vaccination.
<table>
<thead>
<tr>
<th>Disease</th>
<th>Vaccine</th>
<th>Type of Vaccine</th>
<th>Age for Vaccination</th>
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<tbody>
<tr>
<td>Distemper</td>
<td>Canine distemper virus</td>
<td>Modified live virus</td>
<td>First vaccination at 8 weeks; second vaccination at 12 weeks; third vaccination at 16 weeks; revaccinate annually</td>
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<td></td>
<td>and/or</td>
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<tr>
<td></td>
<td>Measles virus</td>
<td></td>
<td>Vaccinate at 6 weeks of age, then vaccinate with distemper vaccine at 12 and 16 weeks. Do not use in bitches of breeding age</td>
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<tr>
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<td>Infectious canine hepatitis virus</td>
<td>Modified live virus</td>
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<td>Killed bacterin</td>
<td>Vaccination schedule is same as for distemper</td>
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<td>Rabies virus</td>
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<td>First vaccination at 3 months of age; revaccinate at 1 year and at least every 3 years thereafter</td>
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<td>Canine parainfluenza virus</td>
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<td><strong>Bordetella bronchiseptica</strong></td>
<td><strong>Killed bacterin or Live attenuated</strong></td>
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