

ZOONOTIC DISEASES OF LABORATORY, AGRICULTURAL, AND WILDLIFE ANIMALS

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Introduction

- **The World Health Organization (WHO) defines Zoonoses (Zoonosis, sing.) as "Those diseases and infections, which are naturally transmitted between vertebrate animals and man."**

In 2000, WHO reported 56 million deaths worldwide:

- 25% were due to infectious agents
- 61% of the infectious agents were zoonotic
- 75% of emerging pathogens were zoonotic

I. Mode of transmission

- Feces
- Urine
- Saliva
- Blood
- Milk

Via aerosol, oral, contact with bedding or animals, etc.

II. **The probability of disease transmission from animals to man is influenced by several factors:**

- Length of time the animal is infective.
- Length of the incubation period in animals (this is important in some diseases with long incubation periods, because the animals may be studied and euthanatized before they become infective for humans).
- The stability of the agent. Most important in direct transmission, where the agent is exposed to environmental changes.
- Population density of the animals in the colony.
- Husbandry practices.
- Maintenance procedures and control of wild rodents and insects.
- Virulence of the agent.
- Route of transmission.

III. **"Emerging zoonoses" are defined as zoonotic diseases caused either by apparently new agents, or by previously known microorganisms, appearing in places or in species in which the disease was previously unknown. New animal diseases with an unknown host spectrum are also included in this definition. Natural animal reservoirs represent a more frequent source of new agents of human disease than the sudden appearance of a completely new agent.** Factors explaining the emergence of a zoonotic or potentially zoonotic disease are usually complex, involving mechanisms at the molecular level, such as genetic drift and shift, and modification of the immunological status of individuals and populations. Social and ecological conditions influencing population growth and movement, food habits, the environment and many other factors may play a more important role than changes at the molecular level.

TABLE 1: EXAMPLES OF ZONOTIC EMERGING DISEASES

Year	Pathogen	Geographic Location of Emergence	Animal Reservoir (suspected or actual) and vector (if any)	Human toll
1999	West Nile virus	U.S.	Birds (primarily <i>Culex</i> spp. Mosquitoes)	4,007 cases 263 deaths
1998 - 1999	Nipah virus	Malaysia, Singapore	Flying foxes, fruit bats (swine secondarily infected)	287 cases 106 deaths
1997	Avian influenza H5N1	Hong Kong	Poultry	18 cases 6 deaths
1994	Sabiá virus	Brazil	Rodents	Unknown
1994	Hendra virus	Australia	Flying foxes, fruit bats	3 cases, 2 deaths
1993	Sin Nombre virus	Four corners area of U.S.	Flying foxes, fruit bats	3 cases, 2 deaths
1992	<i>Bartonella henselae</i>	Worldwide distribution	Cats, fleas	Est. 22,000 cases/yr in U.S.
1991	Guanarito virus	Venezuela	Rodents	Unknown
1986	<i>Ehrlichia chaffeensis</i>	U.S., Europe, Africa, Asia, Middle East	Deer, other mammals (<i>Amblyomma americanum</i> and <i>Dermacentor variabilis</i> ticks)	>800 cases in U.S.
1986	Bovine spongiform encephalopathy	U.K.	Cattle	121 definite or probable vCJD deaths
1982	<i>Borrelia burgdorferi sensu stricto</i>	North America, Europe	Rodents and other mammals, ticks	>145,000 cases
1976	<i>Cryptosporidium parvum</i>	Worldwide	Mammals, esp. calves, sheep, humans	Unknown number of cases, but likely many millions

Diseases included in this handout are principally those wherein a true risk to biomedical facility, agricultural, or wildlife personnel has been documented by published reports of human cases in these settings, or under reasonably similar circumstances.

Disease name is the most commonly accepted term used in the literature. Alternate names are listed in parentheses.

- **Agent** is the specific pathogen(s) that cause(s) the disease, followed by the type of organism it represents.
- **Animal reservoir** section includes the vertebrates in which the infective agent resides, and is subdivided into four categories: hosts, disease, detection and control.
- **Hosts** are the animal sources of the agent.
- **Disease** describes the clinical manifestations, if any, that are manifested in the animal hosts.
- **Detection** describes how the infection may be diagnosed in the hosts.
- **Control** includes methods by which infection in the host(s) can be prevented, treated, or eradicated.
- **Mode of transmission** is the means by which the agent spreads from the reservoir host to humans.
- **Communicability** is a general assessment of the agent's infectivity and the relative ease with which the agent may be transmitted to humans.
- **Humans** section is subdivided into six categories: occurrence, clinical syndromes, incubation period, diagnosis, prevention, and treatment.

- **Occurrence** provides brief information on documented cases and includes the source of the infection and some characteristics of the affected persons.
- **Clinical syndromes** describe the principal clinical features of the disease, including those reported in documented cases.
- **Incubation period** is the time between exposure to the agent and the appearance of clinical signs of disease in humans.
- **Diagnosis** describes the laboratory methods that may be used to detect infection in humans.
- **Prevention** provides information on measures used to avoid or minimize exposure and disease in humans.
- **Treatment** provides information on the manner in which the disease may be treated.
- **Reporting requirement** under the animal reservoir section are those diseases required to be reported to the United States Department of Agriculture, if diagnosed in animals; in the humans section, those required to be reported to the local public health authorities and/or to the Centers for Disease Control, if diagnosed in humans.

Amebiasis

(Humans: Amebic Dysentery, Amebiosis)

Agent: *Entamoeba histolytica*; protozoa

Animal Reservoir:

Hosts: Macaques, baboons, squirrel monkeys, and other nonhuman primates; occasionally dogs and cats.

Disease: Asymptomatic to severe diarrhea (hemorrhagic or catarrhal) with weight loss, depending on strain of organism and invasiveness of the condition; lesions outside of the intestinal tract occasionally develop.

Detection: Microscopic examination of fresh wet fecal smears for trophozoites or cysts. Repeated examinations may be necessary due to periodic fecal shedding. Cysts may be identified by use of zinc sulfate flotation examination of feces. Colonoscopy with scraping or biopsy of ulcers. An ELISA-based test is available and immunostaining is also useful.

Control: Antimicrobial treatment or culling of carriers; strict sanitation practices.

Mode of transmission: Fecal-oral. Flies and cockroaches can spread cyst forms of the agent.

Communicability: High, due to potential for asymptomatic carriers (humans) that can act as a source of infection for nonhuman primates.

Reporting Requirement: Not reportable.

Humans:

Occurrence: Man is the natural host and is the usual source of infection for animals. Clinical cases in laboratory animal settings have not been documented.

Clinical syndromes: Asymptomatic to acute or fulminating dysentery with fever, chills, and hemorrhagic or catarrhal diarrhea sometimes alternating with constipation; extraintestinal abscesses may develop especially in the liver.

Incubation period: Ranges from two to four weeks, may be longer.

Diagnosis: For intestinal amebiasis: examination of fresh stool smears for trophozoites; colonoscopy; serologic testing for invasive forms of the disease. For hepatic abscesses: ultrasonography, MRI, or CT with image-guided needle aspiration.

Prevention: Good hygiene; strict sanitation; barrier methods of protection; vermin control programs.

Treatment: Tinidazole and metronidazole are unique in that they are effective both in the bowel lumen and wall and other tissues, both must be used in combination followed by iodoquinol, paromomycin, or diloxanide furoate. For hepatic abscess, must be followed by treatment with chloroquine.

Prognosis: If untreated, mortality rate is high; with treatment, good.

Reporting Requirement: Reportable to local health department in Arizona.

B Virus

Agent: *Cercopithecine herpesvirus 1*, *Herpesvirus simiae*, Herpes B; alphaherpesvirus.

Animal Reservoir:

Host: Macaques.

Taught as a separate class for those working with Macaque nonhuman primates.

Balantidiasis

Agent: *Balantidium coli*; ciliated protozoa.

Animal Reservoir:

Hosts: Pigs, nonhuman primates (macaques, baboons, squirrel monkeys and other nonhuman primates), guinea pigs.

Disease: Asymptomatic to watery diarrhea and ulcerative enterocolitis, weight loss; rectal prolapse.

Detection: Examination of fresh wet fecal smears for trophozoites or cysts; histologic examination; autofluorescence microscopy of feces.

Control: Sanitation; treatment of infected animals with antimicrobials.

Mode of transmission: Fecal-oral.

Communicability: Humans have a high natural resistance to this parasite, but infection may pose more substantial health hazards in debilitated individuals.

Reporting Requirement: Not reportable.

Humans:

Occurrence: In human cases, contact with pigs is the most likely source of infection. Up to 100% of pigs more than four weeks old on one farm were tested positive for *B. coli* cysts in their feces. Waterborne epidemics occasionally occur in areas of poor sanitation. *Balantidium coli* can complicate other gastrointestinal tract diseases of humans.

Clinical syndromes: Diarrhea alternating with constipation, gastroenteritis, tenesmus, nausea, vomiting.

Incubation period: Unknown, possibly a few days.

Diagnosis: Examination of fresh wet smear of stool for trophozoites or cysts. Colonoscopy with scraping or biopsy of ulcers.

Prevention: Good hygiene and strict sanitation; barrier methods of protection.

Treatment: Tetracycline, iodoquinol, paromomycin, metronidazole; supportive care.

Prognosis: Good

Reporting Requirement: Not reportable.

Brucellosis

(Livestock: Contagious Abortion, Bang's Disease; Humans: Undulant Fever, Malta Fever, Mediterranean Fever)

Agent: *Brucella abortus*, *B. canis*, *B. melitensis*, *B. ovis*, *B. suis*; aerobic, gram-negative coccobacilli.

Animal Reservoir:

Hosts: *Brucella melitensis*, *B. ovis*, *B. abortus* (occasionally)—sheep, *B. melitensis*—goats, *B. suis*—pigs, *B. canis*—dogs.

Disease: Infection of the genital tract causing infertility, abortion with chronic vaginal discharge; orchitis, prostatitis, epididymitis. Arthritis, lymphadenopathy, uveitis, and diskospondylitis may occur.

Detection: Culture, using selective media, of genital discharges, aborted fetuses, udder secretions, and tissues; PCR assay; rose bengal plate agglutination and complement-fixation (CF) tests are recommended for screening flocks and individuals; enzyme-linked immunosorbent assay (ELISA).

Control: Vaccination available (live-agent vaccines superior to inactivated) for cattle, dogs, and goats; animal testing (such as the Brucella milk ring test [BRT] in cattle) and removal programs are frequently used; long-term antimicrobial therapy has been successful in dogs.

Mode of transmission: Direct contact of broken skin or conjunctiva with genital secretions, aborted fetuses, fetal fluids, and urine from animals; inhalation of aerosols from tissues; ingestion of unpasteurized milk or cheese.

Communicability: High with exposure to infected livestock or their tissues. The disease is uncommon in countries where control programs have largely eradicated the disease in livestock. Rarely, dogs can be infected with various strains of *Brucella* spp., and may serve to disseminate the agent to livestock. *Brucella abortus* and *B. melitensis* appear to be the agents of most zoonotic importance, followed by *B. suis*. It is unclear whether *B. ovis* has zoonotic importance. Since brucellosis in dogs is not uncommon, the risk may be low to moderate with *B. canis*.

Reporting Requirement: Must be reported to the Veterinary Services National Animal Health Program, USDA when diagnosed in cattle, bison, elk, and pigs.

Humans:

Occurrence: Rare in the US; almost all cases are imported. A survey of veterinarians in the Netherlands indicated that four of 89 (5%) had antibodies to *B. abortus*. Although two of the veterinarians were cattle practitioners; one was a swine practitioner, and the other worked for government, industry, or academia. In a serologic survey of 43 veterinarians in Florida, none had antibodies to *B. canis*, although six had antibodies to other *Brucella* spp. However, in a seroepidemiologic study in Oklahoma, 53 of 73 (72%) practicing veterinarians had antibodies to *B. canis*. An animal technician had serologic evidence of *B. canis* infection. A fatal case of brucellosis due to *B. suis* was reported in a pig farmer that had not been exposed to livestock for at least 20 years.

Clinical syndromes: Acute or chronic onset with intermittent and persistent fever, anorexia, sweating, headache, myalgia, irritability, arthralgia, weakness; cervical and axillary lymphadenopathy, hepatosplenomegaly, genitourinary infection.

Incubation period: Ranges from five days to five months, average one to two months; may be longer.

Diagnosis: Blood culture during the acute phase, using the lysis concentration method; serologic diagnosis by enzyme immunoassay (EIA). Specialized serologic techniques are needed to detect *B. canis* antibodies because of cross-reaction with other species within the genus.

Prevention: Personal protective equipment (PPE); strict hygienic measures for disposal of placenta, discharges, fluids, and fetuses after abortions; disinfection of contaminated surfaces; avoidance of eating unpasteurized dairy products. Satisfactory vaccines are not available for humans.

Treatment: Combination of rifampin or streptomycin, and doxycycline, for at least six weeks.

Reporting Requirement: Reportable to local health department in Arizona and the CDC.

Campylobacteriosis

(Vibronic Enteritis)

Agent: *Campylobacter coli*, *C. fetus*, *C. hyointestinalis*, *C. jejuni*; microaerophilic, gram-negative, rod-shaped bacteria.

Animal Reservoir:

Hosts: Cattle, pigs, chickens, sheep, dogs, cats, ferrets, hamsters, and nonhuman primates (including macaques, baboons, and squirrel monkeys).

Disease: Asymptomatic to watery or mucohemorrhagic diarrhea; abortion and stillbirths due to *C. fetus*; fever, reduced appetite, vomiting. Clinical manifestations may be more severe in young animals.

Detection: Culture of feces on selective media; examination of fresh fecal or tissue samples, using dark-field or phase-contrast microscopy; serial serum samples to document increasing antibody titer by ELISA.

Control: Because *C. jejuni* and *coli* are not routinely cited as potential intestinal pathogens in animals (except for diarrhea in young cats and dogs and in several species of primates), efficacy of antibiotic therapy has been reported infrequently. In certain cases in which animals are severely affected or are a zoonotic threat, antibiotic treatment may be indicated. Before therapy is instituted, isolation and sensitivity tests should be done to prevent development of a carrier state.

Mode of transmission: Fecal-oral and food- (via undercooked meat) or waterborne transmission. Unpasteurized milk has been cited as a principal source of infection in several human cases.

Communicability: Low to moderate if proper sanitation measures are followed. Prevalence of this organism in laboratory nonhuman primate colonies may be low.

Reporting Requirement: Not reportable.

Humans:

Occurrence: Cases of enteritis have been associated with exposure to domestic animals, sheep, and pigs. Asymptomatic laboratory-housed coyotes transmitted the agent to animal technicians.

Clinical syndromes: Often asymptomatic; abdominal pain, malaise, fever, nausea, vomiting, diarrhea; typhoid-like syndrome or reactive arthritis may develop. *C. fetus* causes systemic infections that can be fatal, including bacteremia, endocarditis, meningitis, and focal abscesses.

Incubation period: Ranges from one day to 10 days, usually two to five days.

Diagnosis: Culture of stool.

Prevention: Good hygiene to include washing of hands after handling animals or their feces and wearing of boots and coveralls when working around farm animals and sanitation; detection and treatment of infected animals.

Treatment: Supportive care, including rehydration and electrolyte replacement, as needed. The disease is self-limited, but its duration can be shortened with antimicrobial therapy. Select antimicrobial agents (e.g., erythromycin or ciprofloxacin) may be efficacious during initial stages of disease, but isolation and susceptibility testing should be performed prior to administration. Systemic infections respond to therapy with gentamicin, chloramphenicol, ceftriaxone, or ciprofloxacin.

Reporting Requirement: Reportable to local health department in Arizona.

Capnocytophagosis

Agent: *Capnocytophaga canimorsus*, *C. cynodegmi* (formerly Dysgonic Fermenter-type 2); aerobic gram-negative rod.

Animal Reservoir:

Hosts: Dogs, cats, rodents.

Disease: Asymptomatic in host species.

Detection: Culture, using stringent growth conditions, of saliva and oral mucosa.

Control: Impractical, agent considered to be highly associated within the oral cavity of reservoir hosts.

Mode of transmission: Animal bites or scratches, or contamination with oral secretions.

Communicability: Low if proper animal handling techniques are used. Splenectomy and alcoholism appear to be strong predisposing factors for disease in human cases.

Humans:

Occurrence: No known cases have been reported in animal facilities; however, multiple reports of transmission to humans from pets exist. Purpura fulminans was noted following a dog bite. Two cases in immunocompetent persons were linked to contact with dogs, involving licks and scratches. In one study, 14 individuals developed fever and septicemia after contact with dogs or dog bites; in another review, 42 of 52 human cases were linked to dog or cat bites, scratches or contact. Two cases of fever and erythema, one in an asplenic person, were linked to cat bites

and scratches. Septicemia developed in an immunosuppressed asplenic individual after a cat scratch.

Clinical syndromes: Cellulitis, fever, septicemia, purulent meningitis, endocarditis and septic arthritis; can be fatal. Immunosuppressed and splenectomized patients, as well as alcoholics and those with various chronic diseases, appear to be at highest risk.

Incubation period: Ranges from one to five days.

Diagnosis: Identification of bacteria within neutrophils; isolation by culture.

Prevention: PPE, including gloves; proper training in animal handling and restraint; disinfect wounds following injury or exposure.

Treatment: Penicillin G is the antibiotic of choice.

Cat Scratch Disease

(Humans: Benign Lymphoreticulosis, Bacillary Angiomatosis, Bacillary Peliosis Hepatitis)

Agent: *Bartonella henselae*; aerobic, gram-negative bacilli.

Animal Reservoir:

Hosts: Cats, occasionally dogs.

Disease: Usually asymptomatic; however, may cause reproductive failure in female cats and peliosis hepatitis in dogs.

Detection: Culture; PCR assay of formalin-fixed, paraffin-embedded tissues.

Control: Impractical, agent considered to be highly associated within the reservoir host; control of flea population to reduce transmission between cats.

Mode of transmission: Principally spread by fleas among cats; however, flea-to-human transmission is unlikely. Infection typically occurs after bites or scratches from healthy young cats and occasionally dogs.

Communicability: Low with proper animal handling techniques and protective equipment. This is an emerging pathogen among immunosuppressed individuals in the general population, and warrants appropriate precaution in animal facilities. Veterinary care personnel are generally considered to be at higher risk.

Reporting Requirement: Not reportable.

Humans:

Occurrence: Reports of transmission to humans from pet cats; however, no documented cases in laboratory animal settings. Estimated 22,000-24,000 humans developed cat scratch disease during 1992, of whom 2,000 were hospitalized. A higher rate of suspected cat-scratch disease was documented among veterinary surgeons (18.6%) and veterinary technicians (8.9%) than in non-veterinary workers (1.3%). Pet dogs transmitted the pathogen to two persons, in the absence of any contact with cats, with resulting fever and lymphadenopathy.

Clinical syndromes: Papule at site of lesion within one week after exposure, lymphadenopathy within two weeks, fever, malaise, myalgia, bacillary angiomatosis (particularly in immunosuppressed persons), peliosis hepatitis, lymphadenitis, aseptic meningitis with bacteremia; chronic osteomyelitis.

Incubation period: Ranges from three to 14 days for development of primary lesion, up to 50 days for development of lymphadenopathy.

Diagnosis: History of clinical signs of disease; immunofluorescent antibody (IFA) test; biopsy of lymph node followed by Warthin-Starry silver stain to demonstrate the organism histologically; PCR assay.

Prevention: Proper training in cat handling and PPE; disinfect wounds following injury or exposure from cats.

Treatment: Not generally used or indicated in symptomatic persons since disease is often self-limiting; however, rifampin, erythromycin, or doxycycline can be administered to immunocompromised individuals if disease sequelae are more severe.

Reporting Requirement: Not reportable.

Chlamydiosis

Agent: *Chlamydophila abortus* (formerly *Chlamydophila (Chlamydia) psittaci*—non-avian biotypes), *C. pecorum*, *C. pneumoniae*; obligate, intracellular, gram-negative, coccoid, rod-shaped bacteria.

Animal Reservoir:

Hosts: *C. abortus*—sheep and goats, dogs, cats and guinea pigs; *C. pecorum*—sheep and goats; *C. pneumoniae*—frogs (*Xenopus* sp.). Three reports in frogs were published before identification of *C. pneumoniae*; the agent was, therefore, only described by genus or as *C. psittaci*.

Disease: Asymptomatic; fetal loss (abortion, stillbirth), pneumonia, and enteritis due to *C. abortus* in sheep and goats; keratoconjunctivitis and polyarthritides due to *C. pecorum* in sheep and goats; pneumonia and endocarditis in dogs, keratoconjunctivitis and pneumonitis in cats; conjunctivitis, keratitis, salpingitis in guinea pigs; lethargy, disequilibrium, petechiation, and edema in frogs.

Detection: Histologic examination of tissues; identification of chlamydial inclusions in tissue scrapings; ELISA or PCR or isolation in embryonated chicken eggs or cell culture.

Control: Antimicrobials (e.g., tetracyclines and erythromycin [orally and topically administered]); test and cull infected animals; vaccination in cats and sheep.

Mode of transmission: Contact with animals or their tissues, particularly birth products; inhalation of desiccated excretions or secretions.

Communicability: Moderate with exposure to birth fluids and membranes of sheep and goats. Because pregnant women are particularly susceptible, exposure to sheep and goats, particularly parturient animals, should be avoided. Human infection from zoonotic transmission has only been reported for *C. abortus*.

Reporting Requirement: Not reportable.

Humans:

Occurrence: Disease occurs sporadically in persons exposed to animals. Numerous case reports of infections in pregnant women exposed to sheep in an abattoir, and in farm settings, particularly after exposure to aborting sheep or goats. In one case, Q fever occurred concurrently.

Clinical syndromes: Flu-like illness, conjunctivitis, pneumonia, encephalitis, myocarditis, thrombophlebitis; febrile illness, and abortion in pregnant women.

Incubation period: Ranges from one week to four weeks.

Diagnosis: Detection of increasing IgG antibody titer in paired sera by use of CF or microimmunofluorescent assay (MIA).

Prevention: PPE to prevent inhalation of and direct contact with the agent; disinfection of contaminated waste and environmental surfaces.

Treatment: Antimicrobials, such as tetracycline or doxycycline, erythromycin, levofloxacin, or trovafloxacin.

Reporting Requirement: Not reportable.

Colibacillosis

(Livestock: White Scours, Gut Edema of Swine)

Agent: *Escherichia coli* are gram-negative, aerobic, and facultatively anaerobic medium-sized rods. Strains of *Escherichia coli* that cause diarrhea are of 6 major categories: (1) enterohemorrhagic (O157:H7); (2) enterotoxigenic; (3) enteroinvasive; (4) enteropathogenic; (5) enteroaggregative; and, (6) diffuse-adherent. However, the only strain where the human is **not** the reservoir host is enterohemorrhagic. All information following is on this strain.

Animal Reservoir:

Hosts: Cattle are the most important reservoir; humans may also serve as a reservoir for person-to-person transmission. There is increasing evidence that in North America deer may also serve as a reservoir.

Disease: Calf diarrhea (white scours) is an acute disease causing mortality in calves less than 10 days old. It manifests itself as serious diarrhea, with whitish feces and rapid dehydration. Mastitis

caused by *E. coli* appears especially in older cows with dilated milk ducts. A long-term study of horse fetuses and newborn colts found that close to 1% of abortions and 5% of deaths of newborns were due to *E. coli*. Neonatal enteritis caused by *E. coli* in suckling pigs begins 12 hours after birth with a profuse watery diarrhea, and may end with fatal dehydration. Edema in suckling pigs (gut edema) is an acute disease that generally attacks between 6 and 14 weeks of age. Sudden onset, incoordination, and edema of the eyelids, the cardiac region of the stomach, and sometimes other parts of the body characterize it. During septicemic diseases of fowl, such as cases of salpingitis and pericarditis, pathogenic serotypes of *E. coli* have been isolated. A colibacillary etiology has also been attributed to Hjärre's disease (coligranuloma), which is a condition in adult fowl characterized by granulomatous lesions in the liver, cecum, spleen, bone marrow, and lungs.

Detection: Stool culture. Strains are identified by ability or inability to ferment sorbitol in media such as MacConkey-sorbitol, by demonstrating the presence of Shiga-like toxins, PCR, or immunoassays for enterotoxins.

Control: Vaccines for swine and bovine have been developed.

Mode of transmission: While most people get *E. coli* O157 from contaminated food (such as undercooked ground beef), it also can be passed in the manure (feces) of young calves and other cattle. Animals do not have to be ill to transmit *E. coli* O157 to humans.

Communicability: Although the number of organisms required to cause disease is not known, it is suspected to be very small. The organism can be found on a small number of cattle farms and can live in the intestines of healthy cattle. Meat can become contaminated during slaughter, and organisms can be thoroughly mixed into beef when it is ground. Bacteria present on the cow's udders or on equipment may get into raw milk. Children under 5 years old are most frequently diagnosed with infection and are at greatest risk of developing hemolytic uremic syndrome. The elderly also appear to be at increased risk.

Reporting Requirement: Not reportable.

Humans:

Occurrence: An estimated 73,000 cases of infection and 61 deaths occur in the United States each year.

Clinical syndromes: *E. coli* O157:H7 infection often causes severe bloody diarrhea and abdominal cramps; sometimes the infection causes nonbloody diarrhea or no symptoms. Usually little or no fever is present, and the illness resolves in 5 to 10 days. In some persons, particularly children under 5 years of age and the elderly, the infection can also cause a complication called hemolytic uremic syndrome, in which the red blood cells are destroyed and the kidneys fail. About 2%-7% of infections lead to this complication. In the United States, hemolytic uremic syndrome is the principal cause of acute kidney failure in children, and most cases of hemolytic uremic syndrome are caused by *E. coli* O157:H7.

Incubation period: Can be 2-10 days, usually 3-4.

Diagnosis: *E. coli* O157:H7 is not identified by routine stool cultures. Isolation requires identification of sorbitol-negative colonies of *E. coli* on sorbitol-MacConkey agar followed by serologic testing to confirm the serotype.

Prevention: With respect to man, control measures include: a) personal cleanliness and hygienic practices, sanitary waste removal and b) protection of food products.

Treatment: Antimicrobial therapy does not alter the course of the disease, and may increase the risk of hemolytic-uremic syndrome. Treatment is primarily supportive.

Prognosis: Fair except for the young and elderly.

Reporting Requirement: Reportable to local health department in Arizona and the CDC.

Cryptosporidiosis

Agent: *Cryptosporidium parvum*, *C. canis*, *C. felis*; coccidian protozoa.

Animal Reservoir:

Hosts: Cats, dogs, macaques, baboons, squirrel monkeys, and other nonhuman primates, cattle, sheep, pigs, ferrets, chickens; frogs; rodents.

Disease: Asymptomatic to intractable diarrhea; respiratory tract disease and airsacculitis in chickens; proliferative gastritis in frogs. Disease can be severe in immunocompromised animals.

Detection: Microscopic detection of oocysts in fecal smears that have been stained by use of the acid-fast procedure; commercially available assay can be used to detect *C. parvum*-specific antigen in fecal samples; identification of cryptosporidia in intestinal biopsy specimens by use of histologic examination; detection of IgG antibodies by use of ELISA.

Control: Environmental sanitation; treatment with paromomycin, although its toxicity has been reported.

Mode of transmission: Fecal-oral, possibly airborne.

Communicability: Low; risk is higher if contact occurs with neonatal animals, which are more susceptible and can shed high titers of the organism. Infections in dogs and cats are rare. Oocysts are immediately infective on shedding.

Reporting Requirement: Not reportable.

Humans:

Occurrence: In general, cases are more frequently associated with exposure to livestock than to pet animals. A case-control study of human immunodeficiency virus (HIV) infected individuals, with and without cryptosporidiosis, in the United States, found no difference in overall pet ownership or cat or bird ownership; dog ownership was of borderline significance, indicating that pets were not a major risk factor. Although *C. parvum* is the major species involved in human infection, a study of stool samples from 1,680 patients in England indicated that four were infected with *C. felis* and one with *C. canis* (201); in 80 cases from Peru, two were infected with *C. canis* and one with *C. felis*, indicating that human infections with these species occur. A person with acquired immune deficiency syndrome (AIDS) developed chronic diarrhea following exposure to a cat.

Clinical syndromes: May be asymptomatic or cause profuse watery diarrhea. The agent can cause protracted illness in immuno-compromised persons spreading to the respiratory tract, liver, pancreas, spleen, and lymph nodes.

Incubation period: Likely ranges from one day to 12 days, with an average of seven days.

Diagnosis: Microscopic detection of oocysts in stool smears, stained by use of the acid-fast procedure; detection of cryptosporidia in intestinal biopsy specimens by use of histologic examination; direct fluorescent antibody; ELISA.

Prevention: PPE; sanitation; good hygiene.

Treatment: Supportive care; nitazoxanide. Treatment of underlying AIDS is necessary.

Reporting Requirement: Reportable to local health department in Arizona and the CDC.

Dermatophytosis

(Humans: Ringworm, Jock Itch, Athlete's Foot, Microsporosis)

Agent: *Trichophyton mentagrophytes*, *T. verrucosum*; *Microsporum canis*; saprophytic fungi.

Animal Reservoir:

Hosts: *T. mentagrophytes*, *M. canis*—guinea pigs and rabbits; *M. canis*—cats, dogs, and nonhuman primates; *T. verrucosum*—horses, cattle, sheep, and goats.

Disease: May be asymptomatic, especially in cats. Lesions usually develop on or about the head, typically appearing as patchy areas of alopecia and erythema; crusts are present with an underlying inflammatory reaction. Lesions are pruritic, and may spread to other areas of the body. Secondary bacterial infection may result in abscessation of hair follicles.

Detection: Microscopic examination of hair/skin/fleece scrapings mounted in 10% potassium hydroxide, culture on suitable dermatophyte test media; despite limited sensitivity, affected areas can be examined, using a Wood's UV lamp (for *M. canis* only).

Control: Infection is probably low in barrier-maintained or specific-pathogen-free (SPF) animals; topical treatment with miconazole or clotrimazole; systemic griseofulvin can be used for severe cases, but teratogenic and occasionally hepatotoxic effects are noted; a vaccine for cats is available. Sheep should be shorn prior to their introduction into the animal facility.

Mode of transmission: Direct contact with skin lesions in various animal species; spores can be widely disseminated and persist in the environment. Chronic asymptomatic carrier animals represent a continuing source for transmission. Contaminated fomites such as furniture, grooming tools, or tack.

Communicability: Unknown, but probably low to moderate.

Reporting Requirement: Not reportable.

Humans:

Occurrence: A survey of veterinary staff in two governmental departments in the United Kingdom indicated that ringworm was the most commonly reported zoonosis, with overall prevalence of 24% in 1,625 staff interviewed. An animal attendant responsible for handling *T. mentagrophytes*-infected laboratory animals developed a ringworm lesion on his wrist. Six persons in Japan were infected after exposure to laboratory rats and guinea pigs. Three cases in laboratory animal and research technicians that had contact with guinea pigs were reported.

Clinical syndromes: Flat, spreading, ring-shaped lesions in the skin ("ringworm"). The margin is usually reddish, vesicular, or pustular and may be dry and scaly with crusts. As the lesions expand peripherally, the central areas often clear, leaving apparently normal skin.

Incubation period: Ranges from 10 to 14 days.

Diagnosis: Appearance of characteristic lesions; fluorescence of organisms under UV light (for *M. canis* only); culture on appropriate fungal media.

Prevention: PPE, including gloves; sanitation agents should be labeled as disinfectant and fungicidal. Linens and clothing need to be laundered in hot water and bleach.

Treatment: Thorough bathing with soap and water; daily topical application of fungicide for at least one month; Terbinafine and butenafine require shorter courses and lead to the most rapid response and prolonged remissions. Treatment needs to continue for 2 weeks after clinical clearing; oral fungicides (e.g., griseofulvin, itraconazole, and terbinafine) are effective in treatment of extensive lesions.

Prognosis: Body ringworm usually responds promptly to conservative topical therapy or to oral treatment.

Reporting Requirement: Not reportable.

Echinococcosis

(Hydatid Disease, Hydatidosis)

Agent: *Echinococcus granulosus*, *E. multilocularis*; cestodes.

Animal Reservoir:

Hosts: *Echinococcus granulosus* -dogs are the definitive host and sheep, cattle and other domestic livestock are intermediate hosts. A northern, sylvatic strain is maintained in wolves and wild ungulates (moose and reindeer). The cycle of *E. granulosus* involving dogs and sheep is especially important. *E. multilocularis*—involves foxes and wolves as definitive host and microtine rodents (such as voles) as intermediate host. Domestic dogs and cats become infected when they eat infected wild rodents.

Disease: Infection by strobilar stage typically asymptomatic in final hosts with all species of *Echinococcus*. Cysts most commonly develop in liver and lungs of intermediate hosts.

Detection: In final hosts, observation of the strobilar stage in feces after anthelmintic treatment. Detection of adult worm products in feces: coproantigen by ELISA or copro-DNA by PCR assay. Fecal flotation is unreliable since echinococcal eggs are indistinguishable from eggs of *Taenia* spp. Metacestodes in intermediate hosts usually not discernible before death.

Control: Prevent consumption by dogs of viscera of domestic ungulates and reindeer (*E. granulosus*), and rodents (*E. multilocularis*) that harbor metacestodes. Dogs can be treated with praziquantel every 30 (*E. multilocularis*) or 45 days (*E. granulosus*).

Mode of transmission: Ingestion of eggs shed in the feces of the final hosts (dogs and cats).

Communicability: Low in biomedical research environments.

Reporting Requirement: Not reportable.

Humans:

Occurrence: Human cases have not been reported in laboratory animal settings. Cystic echinococcosis, caused by *E. granulosus*, is endemic in nearly all livestock-rearing countries. Alveolar echinococcosis, caused by *E. multilocularis*, occurs widely in North America and Eurasia. Dogs originating in rural areas may be infected with *E. granulosus* or *E. multilocularis*.

Clinical syndromes: The occurrence of clinical signs of disease depends on the species of *Echinococcus*, cyst location, and size. With *E. granulosus*, cysts can form in the liver, lungs, brain, bones, skeletal muscle, kidneys, spleen, or other tissues. Infection with *E. multilocularis* results principally in hepatomegaly, but spread to lungs and brain may occur late in disease.

Incubation period: Ranges from months to 20 or more years, depending on the species of *Echinococcus*, parasite-burden, rate of growth of the metacestode, the organ(s) affected, and the duration of infection.

Diagnosis: The immunoblot test is the test of choice.

Prevention: PPE; good hygiene. Incinerate or deeply bury infected organs from intermediate hosts. In endemic areas, prevention is by prophylactic treatment of dogs with praziquantel at monthly intervals and preventing feeding of offal to dogs.

Treatment: Surgical resection of cysts; treatment with albendazole.

Prognosis: With *E. granulosus*, about 15% of untreated patients eventually die because of the disease or its complications. With *E. multilocularis*, 90% of patients die within 10 years without treatment.

Reporting Requirement: Not reportable.

Ectoparasitism

Agents: Mites: *Cheyletiella parasitovorax*, *Liponyssoides sanguineus*, *Notoedres cati*, *Ornithonyssus bacoti*, *Sarcoptes scabiei*, and others. Fleas: *Ctenocephalides canis*, *C. felis*, and others. Ticks: *Dermacentor variabilis*, *Rhipicephalus sanguineus*, and others.

Animal Reservoir:

Hosts: Cats, dogs, rabbits, rodents, and other common laboratory animal species may occasionally be infested with these arthropod agents.

Disease: Asymptomatic to severe dermatitis with alopecia, skin thickening, and secondary pyoderma; anemia, debility, decreased reproduction, pruritus. Some of these ectoparasites are important vectors of various bacterial, rickettsial, and viral diseases. For example, ticks transmit babesiosis, ehrlichiosis, Rocky Mountain Spotted Fever, and Lyme Disease to humans.

Detection: Microscopic or direct examination of skin scrapings or tufts of hair; manual collection from the animals or their bedding.

Control: Prompt elimination of infestation from the animals and their habitats is warranted, using appropriate insecticides (e.g., pyrethrins and permethrins, avermectins); nontoxic measures (e.g., insect growth regulators and silica gels) should be used wherever possible; isolation or quarantine of random-source animals; prophylactic topical treatment of animals on arrival at the

facility; thorough cleaning of the environment and ensuring that an appropriate pest prevention and control program has been established.

Mode of transmission: Direct or indirect contact, including infestation of food, bedding, shipping containers, and caging equipment used in conjunction with animal care.

Communicability: Low to moderate; most ectoparasites of laboratory animals are host-specific, and their life cycle often cannot be sustained in modern animal care programs.

Reporting Requirement: Not reportable.

Humans:

Occurrence: There have been several reports of ectoparasitism among animal husbandry and research technicians in laboratory animal care settings. Recognition of animal infestations has sometimes initially been prompted by medical complaints from staff members or pet owners.

Clinical syndromes: Moderate to severe, but transient pruritic dermatitis, eczema, pyoderma, or painful or irritating bites from some arthropods on any area of the skin; more substantial systemic consequences can result from ectoparasites harboring bacterial, rickettsial, or viral agents of human disease.

Incubation period: Immediately following exposure to arthropods.

Diagnosis: Microscopic or direct examination of skin scrapings or tufts of hair.

Prevention: PPE, including gloves when handling animals that are suspect for ectoparasites.

Treatment: Prescribed antiparasitic medication; cleansing baths; vaccination for ectoparasite-borne disease agents.

Reporting Requirement: Not reportable.

Erysipelas

(Livestock: **Rose Disease, Diamond Skin Disease in Swine; Nonsuppurative Polyarthritits in lambs; Post-dipping Lameness in Sheep; Humans: Erysipeloid**)

Agent: *Erysipelothrix rhusiopathiae*; gram-positive, rod-shaped bacteria.

Animal Reservoir:

Hosts: Pigs, chickens, sheep.

Disease: Fever, lethargy, septicemia, non-suppurative chronic arthritis in lambs, calves, and kids, post-dipping lameness in sheep; diskospondylitis, and sudden death; sudden death, fever, arthritis, diamond-shaped skin lesions, necrosis of ear and tail tips in pigs; septicemia in chickens.

Detection: ELISA, culture of blood, tonsils, lymph nodes, or joint fluid; histologic identification of organism in tissues at necropsy.

Control: Antimicrobials; good sanitation of housing environment; routine vaccination program; testing and elimination of carriers; addition of copper sulfate to sheep dips.

Mode of transmission: Direct contact with animals, tissues, or feces; piglets can be infected through skin abrasions around the navel ("joint ill"); insect vectors (e.g., *Dermanyssus gallinae*) have been linked to spread of the disease in chicken flocks. Recovered animals may be carriers for life.

Communicability: Low to moderate in biomedical research environments. Risk of cutaneous infection increases if animal handlers have unprotected cuts or abrasions on hands.

Reporting Requirement: Not reportable.

Humans:

Occurrence: One case report described concomitant infection with *E. rhusiopathiae* and orf in a sheep farmer. Two animal technicians in a chicken-rearing facility were infected after handling sick and dead birds.

Clinical syndromes: Cellulitis, fever, bacteremia, endocarditis, encephalitis, septic arthritis.

Incubation period: Ranges from one day to three days.

Diagnosis: Culture of blood.

Prevention: PPE, including gloves when handling infected animals; good hygiene.

Treatment: Penicillins and, less commonly, tetracyclines.

Reporting Requirement: Not reportable.

Giardiasis

Agent: *Giardia duodenalis*, *G. intestinalis*, *G. lamblia*; flagellate protozoa.

Animal Reservoir:

Hosts: Most domestic and wild mammals, many birds, and humans. Most commonly found in cats, dogs, nonhuman primates (macaques, baboons, squirrel monkeys), ruminants, and rare in pigs and horses.

Disease: Usually asymptomatic; may have diarrhea, with weight loss, vomiting, and anorexia.

Detection: Isolate cysts by use of zinc sulfate fecal flotation; evaluate using light microscopy. Due to intermittent cyst shedding, fecal samples from three consecutive days should be examined.

Control: Sanitation of environment (cysts are inactivated with quaternary ammonium disinfectants, household bleach [1:32 or 1:16 dilution], steam, or boiling water). Disinfectants should be left on surfaces for 5-20 minutes before rinsing. Prompt removal of feces from pens; treatment with antiparasitic agents (fenbendazole for dogs, cats, ruminants, and birds or albendazole for ruminants). Dogs and cats should be bathed after treatment to remove cysts from hair.

Mode of transmission: Fecal-oral.

Communicability: Moderate to high when working with livestock obtained from infected herds. The agent may be shed by asymptomatic animals.

Reporting Requirement: Not reportable.

Humans:

Occurrence: Infection is common, and may be transmitted from animals to humans and vice-versa. Organisms infecting humans and ruminants are morphologically and antigenically similar. One case of transmission from a dog to an animal technician occurred at the University of Arizona approximately 10 years ago.

Clinical syndromes: Usually asymptomatic; may have mild to severe diarrhea with bulky, greasy, frothy, malodorous stools, with cramps, distension, gas, tiredness. Weight loss, vomiting, and anorexia.

Incubation period: Ranges from two to more than 25 days, average of 7 to 10 days.

Diagnosis: Identification of cysts or trophozoites in stool samples or via direct search for trophozoites in the duodenum; document three negative test results in series; ELISA or direct fluorescent antibody assay.

Prevention: Sanitation; personal hygiene. Community chlorination of water does not kill the cyst. For wildlife workers, water should be boiled for one minute; filtration with a pore size of less than 1 µm can also be used.

Treatment: Treatment should be administered even when no symptoms occur since the parasite can be transmitted to other people or animals. Antiparasitic agents (e.g., tinidazole or metronidazole); supportive care.

Prognosis: With treatment and successful eradication of the infection, there are no sequelae. Without treatment, severe malabsorption may rarely contribute to death from other causes.

Reporting Requirement: Reportable to local health department in Arizona and to the CDC.

Hantaviral Diseases

(Humans: Hemorrhagic Fever with Renal Syndrome, Hantavirus Pulmonary Syndrome)

Agent: Hantaan virus; Seoul virus; bunyavirus.

Animal Reservoir:

Hosts: Rats and mice, other wild rodents.

Disease: Asymptomatic.

Detection: Serologic testing for specific antibodies, using ELISA, IFA test.

Control: Exclude wild rodents from laboratory animal facilities; screen rodents prior to acceptance; test rodent-derived cell lines prior to use, particularly those originating from endemic regions.

Mode of transmission: Virus shed in urine, feces, and saliva of persistently infected rodents for months; inhalation of infective aerosols from rodent excreta; wound contamination, conjunctival exposure, ingestion. Rat cell lines have been implicated as a source of virus.

Communicability: Probability of transmission increases during winter months due to lower humidity and closure of circulation system to outside air. Brief periods of exposure have been sufficient to cause human infections.

Reporting Requirement: Not reportable.

Humans:

Occurrence: Korean hemorrhagic fever was noted among professional staff (veterinarians and physicians) at a Japanese university that used rats. A nationwide survey of research institutions in Japan reported that 126 cases of hemorrhagic fever and renal syndrome (HFRS) occurred between 1970 and 1986. The HFRS also occurred in several laboratory staff workers exposed to rats at a university in Belgium and at a cancer research institute in the United Kingdom. Screening of laboratory animal personnel for antibodies to Hantaan virus in Japan, France, the United Kingdom, and Singapore indicated that several persons had experienced subclinical infections. The Belgian university conducted a serologic survey of 60 staff members that had contact with laboratory animals, particularly rats, and found that 30 (50%) of them had evidence of subclinical infection with Hantaan virus. At two other institutions that had no cases of HFRS, only one of 34 (3%) personnel with similar exposures to laboratory animals had antibodies against the virus. Approximately 300 cases of Hantavirus Pulmonary Syndrome have been reported from 31 states since 1993.

Clinical syndromes: HFRS is of variable severity (mortality <5%), with clinical signs of disease related to the strain of virus involved; acute onset of fever, lower back pain, sometimes associated with hemorrhage and nephropathy. Hantavirus pulmonary syndrome (HPS), caused by another species of Hantavirus, Sin Nombre virus, begins as a nonspecific febrile illness followed by a severe increase in pulmonary vascular permeability and rapid progression to a shock-like state. The HPS has not been associated with rats of the genus *Rattus* or mice of the genus *Mus*.

Incubation period: Ranges from a few days to months, average two to four weeks.

Diagnosis: Serologic testing for specific antibodies, using ELISA and the IFA test; RT-PCR assay is the molecular diagnostic test of choice, although the genomic heterogeneity of Hantaviruses can complicate interpretation of results.

Prevention: Respiratory tract protection is necessary to prevent inhalation exposure; good hygiene; disinfection of contaminated waste and work surfaces before cleaning. Avoid exposure to rodent excreta in rural and wildlife settings. If rodent trapping, Risk Management and Safety has a mandatory training requirement, which can be accessed at: <http://fpnew.ccit.arizona.edu/riskmgmt/whatsnew.htm>

Treatment: Intravenous fluid therapy; bed rest; ribavirin given intravenously has been beneficial in some cases.

Reporting Requirement: Reportable to local health department in Arizona and to the CDC.

Leptospirosis

(Livestock: Redwater of Calves; Humans: Weil's Disease, Hemorrhagic Jaundice, Canicola Fever, Dairy Worker Fever)

Agent: *Leptospira canicola*, *L. hardjo*, *L. icterohaemorrhagiae*, *L. interrogans* serovar *ballum*, *L. pomona*, *L. sejroe*, and other *Leptospira* spp; spirochete bacteria.

Animal Reservoir:

Hosts: *Leptospira interrogans* serovar *ballum*—mice; *L. icterohaemorrhagiae*—rats; *L. canicola*, *L. sejroe*—dogs; *L. pomona*, *L. hardjo*—horses, cattle, pigs, sheep, goats; cats; gerbils, hamsters; rarely, squirrel monkeys, baboons, and other nonhuman primates.

Disease: Asymptomatic in mice; calves may have fever, anorexia, dyspnea, icterus, hemoglobinuria, and hemolytic anemia. In cows, there is a sudden drop in milk production, abortions and stillbirths; fever, hematuria, and hepatic and renal disease in dogs; reproductive failure in sheep, goats, and pigs; icterohemorrhagic disease with abortion in squirrel monkeys. Most commonly associated with uveitis or abortions in horses.

Detection: ELISA and MIA test; increasing IgG antibody titer in paired serum samples; detection of leptospire in urine (using dark-field microscopy) or tissues; PCR assay of urine.

Control: Confinement rearing with sanitation of facilities and appropriate animal waste control, especially of urine; regular vaccination program (cattle, dogs); treatment of infected animals with antimicrobials (e.g., penicillins and aminoglycosides in small animals, streptomycin in pigs); isolation or quarantine of sick animals; immunization with a custom-prepared inactivated vaccine was used to control the disease in an endemically infected squirrel monkey colony. Vermin control.

Mode of transmission: Oral ingestion; exposure to contaminated urine, placenta, fetal tissues; inhalation. Organisms can also infect hosts through abrasions in the skin or mucosal surfaces. The leptospire is often transmitted to humans by the ingestion of food and drink contaminated by the urine of the reservoir animals. Recreational cases have followed swimming or rafting in contaminated water, and occupational cases occur among sewer workers, rice planters, abattoir workers, and farmers. Sporadic urban cases have been seen in the homeless exposed to rat urine.

Communicability: Low to moderate.

Reporting Requirement: Not reportable.

Humans:

Occurrence: An animal technician developed jaundice after bloodborne exposure to a dog with jaundice. The dog and the technician had antibodies to *L. icterohaemorrhagiae* and *L. canicola*. A seroprevalence study of 35 animal technicians indicated that 32 (91%) had antibodies to several leptospiral serovars, compared with four of 20 (20%) laboratory personnel without animal exposure. The animal technicians had *Leptospira* antibody profiles that were similar to those of mice, rats, guinea pigs, and rabbits in their facility, with prevalence by species ranging from 71 to 90%. In a cross-sectional study of university employees working with an infected swine herd, nine of 110 (8%) were serologically confirmed as cases.

Clinical syndromes: Clinical illness can vary from asymptomatic to fatal liver and kidney disease. In the biphasic form, symptoms begin as mild flu-like illness with fever, headaches, rash, and myalgia; following 1-3 days of improvement symptoms begin again with the addition of meningitis, uveitis, rash, adenopathy, and rarely hemorrhagic pneumonia. In the icteric form (Weil's syndrome), there is impairment of renal and liver function, abnormal mental status, hemorrhagic pneumonia, and hypotension.

Incubation period: Ranges from 2-20 days, average of 10 days.

Diagnosis: Serologic testing for specific antibodies, using ELISA, enzyme immunosorbent assay, or IFA test; PCR; isolation of leptospire from blood or CSF within seven to 10 days of infection; isolation from urine within 10 days of infection.

Prevention: PPE to prevent exposure of uncovered skin or mucous membranes in contaminated settings; good hygiene.

Treatment: Penicillin, cephalosporins, tetracyclines, erythromycin; more severe infections may require intravenously administered antimicrobials.

Prognosis: Without jaundice, the disease is almost never fatal. With jaundice, the mortality rate is 5% for those under age 30 and 30% for those over age 60.

Reporting Requirement: Reportable to local health department in Arizona.

Lymphocytic Choriomeningitis

Agent: Lymphocytic choriomeningitis virus (LCMV); arenavirus.

Animal Reservoir:

Hosts: Mice, rats, hamsters, guinea pigs, dogs, pigs, and monkeys. Nonhuman primates in zoological settings have experienced outbreaks after the accidental feeding of infected mice.

Disease: The pattern of disease in animals depends on age of animals, strain and dose of virus, and route of inoculation. Asymptomatic to runting and chronic wasting in mice; asymptomatic in guinea pigs and hamsters; dyspnea, anorexia, lethargy, jaundice, and mortality in marmosets and tamarins.

Detection: Virus isolation in cell culture.

Control: Exclude wild rodents from laboratory animal facilities; screen rodents prior to acceptance; test rodent-derived cell lines prior to use.

Reporting Requirement: Not reportable.

Mode of transmission: Contaminated tumors or cell lines are the usual source of LCMV in laboratory outbreaks. Transmission to humans by parenteral inoculation, ingestion, inhalation, and splash contamination of mucous membranes with infective secretions (urine, feces and saliva); other routes include contact with contaminated bedding material and infected ectoparasites. Athymic and severe-combined-immunodeficient mice pose a special risk to humans by harboring silent, chronic infections. The large number of outbreaks attributed to hamsters suggests that they may be amplifying hosts for the virus. Transmission by aerosolization poses a particular hazard for pregnant women. The virus is not spread person to person, though vertical transmission occurs.

Communicability: Low if appropriate protective measures are taken.

Humans:

Occurrence: A flu-like illness due to LCMV in animal technicians and research personnel exposed to nude mice and hamsters that were inoculated with infected tumor cells was reported. A few cases also had aseptic meningitis. Additionally, serologic screening of personnel indicated that 10 to 24% experienced subclinical infection with LCMV. Seroconversion to LCMV occurred in two zoo veterinarians following bite wounds from and necropsy examinations of infected marmosets and tamarins. On May 3, 2005, the CDC received a report of severe illness in 4 patients who had received organ transplants. 3 of the 4 patients died. The virus was traced back to an infected hamster belonging to the donor.

Clinical syndromes: Symptoms are biphasic. The prodromal illness is characterized by fever, chills, headache, myalgia, cough, vomiting, lymphadenopathy, and rash with occasional pneumonia. After 3-5 days, the fever subsides and recurs in 2-4 days with the meningeal phase, characterized by headache, nausea, vomiting, lethargy. Arthralgias and chorioretinitis may develop later. The LCMV has been recognized as a neuroteratogen in humans.

Incubation period: Ranges from one week to three weeks.

Diagnosis: CF; PCR; virus isolation assays.

Prevention: PPE, including gloves for handling rodents or their tissues; good hygiene. Pregnant women should be advised of the dangers to their unborn children inherent in exposure to rodents.

Treatment: Supportive care.

Prognosis: Fatalities are rare. The illness usually lasts 1-2 weeks, though convalescence may be prolonged.

Reporting Requirement: Reportable to local health department in Arizona.

Orf

(Contagious Pustular Dermatitis, Contagious Ecthyma)

Agent: Orf virus; parapoxvirus.

Animal Reservoir:

Hosts: Sheep, goats, reindeer.

Disease: Pustular lesions principally around the lips; also on gums, nostrils, and occasionally, teats and udders; interdigital and coronet lesions can lead to lameness; atypical presentation as warts on distal aspect of limbs; disease in goats more severe than that in sheep. Sheep can be reinfected.

Detection: Clinical lesions; detection of IgG antibodies by use of ELISA.

Control: Usually self-limiting; vaccination with live attenuated virus or scarification with a suspension of infective scab material.

Mode of transmission: Direct contact with mucous membranes of infected animals, with udders of nursing dams; virus highly resistant to desiccation and can persist in scabs and crusts for years; communal equipment used between animals in sheep flocks.

Communicability: High when exposed to animals with active lesions. The disease is uncommon in laboratory animal facilities as sheep are generally required to be free of clinical signs of disease prior to acceptance.

Reporting Requirement: Not reportable.

Humans:

Occurrence: The disease is common in persons with occupational exposure to sheep. In the United Kingdom, 15 to 29% of farm workers reported having had orf. A study of English farm workers indicated an annual incidence of 2.8%. Several case reports document human infection due to occupational exposure in agricultural and research settings. Cases usually involved handling infected animals without gloves. In a laboratory setting, two researchers were infected after being bitten by an affected lamb during passage of an orogastric tube. In one report of a sheep farmer, orf was complicated by erysipelas.

Clinical syndromes: Pustular dermatitis, usually on the hands and face.

Incubation period: Ranges from three to six days.

Diagnosis: Clinical signs of disease; detection of IgG antibody, using a cell culture immunofluorescence test; histologic examination of skin biopsy specimen.

Prevention: PPE, especially gloves; good hygiene.

Treatment: None. Typically, disease is self limiting over three to six weeks; secondary bacterial infections may occur.

Reporting Requirement: Not reportable.

Pasteurellosis

(Livestock: Shipping Fever, Transport Fever, Hemorrhagic Septicemia; Rabbits: Snuffles)

Agent: *Pasteurella multocida*; facultative anaerobic gram negative rod-shaped bacteria.

Animal Reservoir:

Hosts: Cats, rabbits, dogs, pigs.

Disease: Asymptomatic in cats and dogs; respiratory signs of variable severity, rhinitis, otitis, subcutaneous and visceral abscesses and genital infections in rabbits. Up to 30 to 90% of

healthy rabbits may be carriers in conventional rabbit colonies; in pigs, atrophic rhinitis can develop in co-infections with *Bordetella bronchiseptica*.

Detection: Culture; IFA test on nasal swab specimens.

Control: Antimicrobials (e.g., enrofloxacin) may only provide temporary remission and alleviation of clinical signs of disease. Vaccines for rabbits have been developed.

Mode of transmission: Bite wounds, possibly aerosol.

Communicability: Low, but may be greater among debilitated or immunocompromised persons. Between 30-50% of all cat bites become infected; dog bites only 5% of the time with 75% of infected cat bites and 50% of dog bites *Pasteurella sp.*

Reporting Requirement: Not reportable.

Humans:

Occurrence: Infection in a pregnant woman from a cat bite resulted in fatal congenital pneumonia. Other reports describe the development of meningitis and pericardial tamponade in one individual, and pneumonia in an immunosuppressed person following a cat bite. An animal technician developed a local abscess after a bite sustained from a rabbit with rhinitis. In pig breeders, culture revealed the presence of *P. multocida* in the oropharynges of 19 of 49 (39%) examined.

Clinical syndromes: Cellulitis, erythema and painful swelling at site of bite; septicemia, peritonitis.

Incubation period: Up to 24 h.

Diagnosis: Culture of bite or scratch wounds.

Prevention: PPE, including gloves; appropriate restraint of animals; sanitation.

Treatment: Vigorous cleansing and irrigation. X-rays to look for foreign bodies and fractures. Penicillin, tetracycline, cephalosporins, fluoroquinolones, or azithromycin plus clarithromycin. Immunocompromised patients and especially individuals without functional spleens are at risk for developing overwhelming bacteremia and sepsis following animal bites and should also receive prophylaxis, even for low-risk bites.

Reporting Requirement: Not reportable.

Plague

(Humans: Black Death, Yersiniosis)

Agent: *Yersinia pestis*, a small bipolar-staining gram-negative rod.

Animal Reservoir:

Hosts: Wild rodents.

Disease: Plague epizootics cause nearly 100% mortality in affected wild rodent and rabbit populations. Cats with bubonic plague typically present with fever, anorexia, lethargy, and an enlarged lymph node that may be abscessed. Oral and lingual ulcers, skin abscesses, ocular discharge, diarrhea, vomiting, and cellulitis have also been documented. Cats with primary septicemic plague present with fever, lethargy, anorexia, diarrhea, vomiting, tachycardia, weak pulse, and respiratory distress.

Detection: FA test of a glass slide smear. Serologic antibody tests can be confirmatory but require samples be taken 2-3 weeks apart to demonstrate a rising titer.

Control: Pet owners in enzootic areas should keep their pets from roaming and hunting, limit contact with rodent or rabbit carcasses, and use appropriate flea control.

Mode of transmission: Transmitted among rodents and to humans by the bites of fleas or direct contact. The patient with pneumonia can transmit the infection to others by droplets. Cats and dogs are usually exposed to *Y. pestis* by mucous membrane contact with secretions or tissues of an infected rodent or rabbit or by the bite of an infected flea.

Communicability: On average, 10 human plague cases are reported each year in the USA.

Reporting Requirement: Not reportable.

Humans:

Occurrence: It is endemic in California, Arizona, Nevada, and New Mexico. Of the 23 patients who developed cat-associated plague in the USA between 1977 and 1998, 6 were veterinary staff; the rest were cat owners or others handling a sick cat. In 2004, 2 cats in New Mexico were diagnosed with bubonic plague. Also in 2004, several wood rats and prairie dogs were found dead from the plague in the panhandle of Texas.

Clinical syndromes: Sudden onset with high fever, malaise, tachycardia, intense headache, delirium, myalgia. If pneumonia develops, tachypnea, productive cough, blood-tinged sputum, and cyanosis also occur. Axillary, inguinal, or cervical lymph nodes become enlarged (bubo) and tender and may suppurate and drain. There may be signs of meningitis. With hematogenous spread, the patient may rapidly become toxic and comatose, with purpuric spots (black plague) on the skin. Primary plague pneumonia is a fulminant pneumonitis with bloody, frothy sputum and sepsis. It is usually fatal unless treatment is started within a few hours.

Incubation period: 2-10 days.

Diagnosis: Smears and cultures from aspirates of buboes. Rising titers demonstrated by convalescing patients by agglutination tests.

Prevention: Drug prophylaxis with tetracycline for persons exposed to high risk potential. The use of gloves, surgical masks, eye protection, and standard hygiene and disinfection procedures is recommended. Plague vaccines have not proven to be effective.

Treatment: Antimicrobials (e.g., streptomycin, gentamicin, or doxycycline) for 10 days. Patients with plague pneumonia need to be isolated.

Prognosis: When pneumonia or meningitis develops, the outcome is often fatal.

Reporting Requirement: Reportable to local health department in Arizona and to the CDC.

Q Fever

(Humans: Query Fever, Balkan Influenza, Balkan Grippe, Pneumorrhickettsiosis, Abattoir Fever)

Agent: *Coxiella burnetii*; obligate intracellular rickettsia.

Animal Reservoir:

Hosts: Cattle, sheep and goats (main reservoirs).

Disease: Usually asymptomatic; in cases of severe infection, abortion and reproductive failure may occur.

Detection: Detection of antibodies against phase-I antigen by use of ELISA (more useful on a flock than an individual basis); PCR assay; immunohistochemical staining of tissues.

Control: *Coxiella* is resistant to heat and drying. Thus, it survives in dust, on the fleece of infected animals, or in inadequately pasteurized milk. Serologic testing followed by culling of infected animals; strict sanitation practices, especially during lambing since the organism is found in extremely high concentrations in the placenta and amniotic fluid; maintenance of *C. burnetii*-free animal populations; antimicrobials (e.g., tetracycline, chloramphenicol).

Mode of transmission: The agent is unique among rickettsiae in that it is usually transmitted to humans not by arthropods but by inhalation or ingestion. Transmission by cows and goats is principally through the milk and placenta and by sheep through feces, placenta, and milk. Dry feces and milk, dust contaminated with them, and tissues of these animals contain large numbers of infectious organisms that are spread by the airborne route. Inhalation of contaminated dust and of droplets from infected animal tissues is the main source of human infection. Outbreaks have been described in association with parturient cats. Spread from human-to-human does not occur despite the presence of pneumonitis but maternal-fetal infection can occur.

Communicability: Occupational exposure is highly linked to the risk of acquiring infection from animals. There is an occupational risk for animal handlers, slaughterhouse workers, veterinarians, and laboratory workers. In research facilities, if sheep are properly screened for infection, the risk is substantially less.

Reporting Requirement: Not reportable.

Humans:

Occurrence: A survey in the United Kingdom indicated that 29 of 87 (33%) abattoir workers, 17 of 61 (28%) veterinarians, and 24 of 193 (13%) farm families had antibodies. In contrast, only 11 of 697 (2%) of the general population had antibodies. In a serosurvey of personnel at veterinary schools in California, and Minas Gerais, Brazil, 14 of 138 (10%) and 48 of 219 (22%), respectively, had antibodies. Sporadic cases and outbreaks have been reported in several biomedical research institutions. Serosurveys in laboratory animal settings have indicated that personnel potentially exposed to sheep have a greater prevalence of antibodies (16 to 18%) than do non-exposed groups (0.3 to 0.6%). However, during outbreaks, a considerably higher number of exposed personnel had antibodies. Serosurveys have also uncovered the retrospective occurrence of cases.

Clinical syndromes: Acute infection results in headaches, fevers, chills, and sweats; myalgias, pneumonia with or without hilar lymphadenopathy, fatigue, chest pain, sore throat, nausea, vomiting and diarrhea. Chronic infection results in granulomatous hepatitis, CNS manifestations, and endocarditis. Spontaneous abortion can occur in pregnant women. The course could be acute or chronic and relapsing.

Incubation period: Ranges from one to three weeks.

Diagnosis: Detection of increasing IgG antibody titer against phase-II antigen, in paired sera by use of ELISA or IFA test. PCR is the most useful test.

Prevention: PPE, including respiratory tract protection where airborne hazards exist; good hygiene; human vaccines have undergone clinical trials.

Treatment: Tetracyclines administered orally for 15 to 21 days have been effective. The new macrolides.

Prognosis: Even in untreated patients, the mortality rate is low, except when endocarditis develops.

Reporting Requirement: Reportable to local health department in Arizona and to the CDC.

Rabies

(Humans: Hydrophobia, Lyssa)

Agent: Rabies virus; rhabdovirus.

Animal Reservoir:

Hosts: Biting species that cause rabies in the US are geographically determined and include raccoons in the East, including New England; skunks in New England, in the Midwest and Southwest, and in California (skunk risk is high and increasing in many areas); coyotes in Texas; and foxes in the Southwest, in New England, and in Alaska. Dogs and cats are infected often in developing countries (including the Mexican border), but are rarely infected in the US. Recent fatal cases in the US were acquired from bats and raccoons. Rodents and lagomorphs (e.g., rabbits) are unlikely to have rabies because they cannot survive the disease long enough to transmit it.

Disease: Initial clinical signs of disease are extremely variable with change of behavior usually the first noted symptom; hydrophobia, aerophobia, agitation, confusion, limb pain, paresthesia, ataxia, paralysis. The various forms of disease range from "furious" to "paralytic," on the basis of areas of the central nervous system affected. Death can occur within two to seven days of illness.

Detection: Detection of viral antigen in brain by use of the direct fluorescent antibody test; confinement and daily observation of healthy dogs, cats, and ferrets for 10 days after bite injury to humans to observe for behavioral signs suggestive of infection that would warrant necropsy. Brain tissues for testing must include the hippocampus, medulla oblongata, and cerebellum, and must be refrigerated.

Control: Vaccination of laboratory dogs, cats, and ferrets; quarantine, euthanasia, and diagnostic testing of animals manifesting signs of disease. Guidelines for control and prevention are published annually by the National Association of State Public Health Veterinarians. Requirements for vaccination vary by geographic region, depending on endemic status of virus, as determined by public health authorities. There is no treatment for clinical disease.

Mode of transmission: Bite of rabid animal or inoculation of infective saliva into fresh wounds or mucous membranes.

Communicability: Low if facility acquires animals with verified vaccination history or with no possible exposure to reservoir species.

Reporting Requirement: Reportable to the CDC.

Humans:

Occurrence: No reported cases among persons in laboratory animal settings. Globally, an estimated 30,000-70,000 deaths occur annually.

Clinical syndromes: The prodromal syndrome consists of pain at the site of the bite in association with fever, malaise, nausea, and vomiting. The skin is sensitive to changes of temperature, especially air currents. About 10 days later, the CNS stage begins, which may be either encephalitic (“furious”) or paralytic (“dumb”). The encephalitic form produces the classic rabies manifestations of delirium alternating with periods of calm, when attempts at drinking cause extremely painful laryngeal spasms (hydrophobia). In the less common paralytic form, an acute ascending paralysis resembling Guillain-Barré syndrome predominates. Both forms progress relentlessly to coma, autonomic nervous system dysfunction, and death despite intensive support.

Incubation period: May range from 10 days to many years but is usually 3-7 weeks.

Diagnosis: Animals involved in biting should be kept under observation for up to 10 days. Specific immunofluorescent antibody staining of brain tissue, skin, or mucosal scrapings; virus isolation. PCR of the CSF or saliva offer definitive diagnosis.

Prevention: Raccoons, skunks, bats, and foxes should be presumed to be rabid. Pre-exposure immunization series if increased risk of occupational exposure among persons in endemic regions; immediate and thorough postexposure wound disinfection and prophylaxis by administration of human rabies immune globulin at the site of bite wound, and concurrent administration of rabies vaccine. National standards address rabies prevention for persons in the United States.

Treatment: Medical decisions are based on recommendations of the US Public Health Service Advisory Committee. Supportive care with attention to the airway, maintenance of oxygenation, and control of seizures. Treatment modalities include a combination of rabies vaccine, rabies immune globulin, monoclonal antibodies, ribavirin, interferon- α and ketamine. Corticosteroids should not be used.

Prognosis: Once the symptoms have appeared, death almost inevitably occurs after 7 days, usually from respiratory failure. There have been 4 documented surviving cases; all received postexposure prophylaxis.

Reporting Requirement: Reportable to local health department in Arizona and to the CDC.

Rat Bite Fever

(Humans: Spirillary Fever, Haverhill Fever, Epidemic Arthritis Erythema, Sodoku)

Agent: *Streptobacillus moniliformis*, gram-negative rod-shaped bacteria. *Spirillum minus*, gram-negative spiral-shaped bacteria.

Animal Reservoir:

Hosts: Wild or laboratory rats, mice; rarely, cats and nonhuman primates.

Disease: Asymptomatic in rodents because agents are considered to be highly associated within the oral cavity; endocarditis and arthritis in nonhuman primates.

Detection: Isolation of the agents from the oral cavity, nares, or conjunctival sacs on appropriate culture medium. Animal inoculation is used for the isolation of *S. minus*; PCR assay.

Control: Cesarean-derived rodents are free of the agent; wild rodent control for indoor and outdoor animal facilities; separation of nonhuman primates from rodents.

Mode of transmission: Most frequently occurs from animal bites. Agent transmitted by urine or secretions of the mouth, nares or conjunctival sacs. Indirect inoculation by contaminated fomites through trauma to unprotected skin.

Communicability: Unknown but probably low.

Reporting Requirement: Not reportable.

Humans:

Occurrence: An animal technician developed undulating fever and myalgias following a rat bite. Inhabitants of rat-infested slum dwellings and laboratory workers are at greatest risk.

Clinical syndromes: *Streptobacillus moniliformis*: chills, fever, headache, weakness; regional lymphadenopathy. *S. minus*: additional symptoms are: myalgia, arthritis and that the original rat bite, unless secondarily infected, heals promptly, but 1 to several weeks later the site becomes swollen, indurated, and painful; assumes a dusky purplish hue; and may ulcerate. The relapsing pattern of fever for 3-4 days alternating with afebrile periods lasting 3-9 days may persist for weeks.

Incubation period: *Streptobacillus moniliformis*: fewer than 10 days. *S. minus*: two weeks to two months.

Diagnosis: Darkfield examination of exudates or aspirations; animal inoculation since *S. minus* cannot be cultured in media.

Prevention: PPE, including gloves; thoroughly wash bite wounds; proper restraint techniques for handling animals.

Treatment: Penicillin or tetracyclines for seven to 10 days. Tetanus prophylaxis should be considered.

Prognosis: Without treatment, the mortality rate is 10%. Prompt diagnosis and treatment markedly reduces this rate.

Reporting Requirement: Not reportable.

Salmonellosis

Agent: Human infections are caused almost exclusively by *Salmonella enterica* subspecies *enterica* of which 3 serotypes-typhi, typhimurium, and choleraesuis-are predominantly isolated; facultative anaerobic gram-negative rod-shaped bacteria.

Animal Reservoir:

Hosts: Reptiles, amphibians, guinea pigs, mice, rats, chickens, pigs, cattle, sheep, horses, cats; rabbits, nonhuman primates (macaques, baboons, squirrel monkeys).

Disease: Asymptomatic to septicemia, diarrhea, gastroenteritis; abortion.

Detection: Culture of feces.

Control: Good programs of sanitation in animal housing areas; strict attention to proper methods of animal waste disposal; purchase of *Salmonella*-free animals; broad-spectrum antimicrobials used parenterally to treat septicemia, with further treatment based on antimicrobial susceptibility pattern of agent. For agricultural animals, treatment with antimicrobial agents is controversial. Oral antibiotics may deleteriously alter the intestinal microflora, interfere with competitive antagonism, and prolong shedding of the organism. There is also concern that antibiotic-resistant strains of salmonellae selected by oral antibiotics may subsequently infect humans. Prevalence of the agent in laboratory nonhuman primate colonies may be low. In 1970, the FDA prohibited the distribution and sale of baby turtles with shells 4 inches in length or less, after a quarter million infants and small children developed turtle-associated salmonellosis. Turtles with shells smaller than 4 inches are dangerous because children can put them in their mouths.

Mode of transmission: Fecal-oral, usually from contaminated food or drink.

Communicability: High when exposed to infected animals or birds. To date, human infections have not been associated with cats.

Reporting Requirement: Not reportable.

Humans:

Occurrence: The CDC estimates that the fecal carriage rate of *Salmonella* spp in pet reptiles is >90% and that there are approximately 74,000 cases of reptile-associated salmonellosis in the USA annually. Carriage rate in wild North American turtles is low (<5%). In recent years, there has been a resurgence in the illegal sale of baby turtles.

Clinical syndromes: Serotype typhi causes Typhoid Fever, which is characterized by malaise, headache, cough, sore throat, abdominal pain, and constipation with relapses for up to 2 weeks. A rash commonly appears after 2 weeks. Serotype typhimurium causes fever and chills, nausea and vomiting, cramping, and diarrhea. Serotype choleraesuis causes fevers accompanied by bacteremia and local infection in joints, bone, pleura, pericardium, lungs, or other sites.

Incubation period: For Enteric Fever, 5-14 days; for gastroenteritis, 8-48 hours.

Diagnosis: For Typhoid Fever, blood culture; for gastroenteritis, fecal culture.

Prevention: Good hygiene; appropriate PPE, including gloves. Adequate waste disposal and protection of food and water supplies from contamination. Human carriers should not be allowed to handle food supplies or work with animals. Vaccine is available for travelers.

Treatment: For Typhoid Fever, several antibiotics, including ampicillin, azithromycin, chloramphenicol, third-generation cephalosporins, and trimethoprim-sulfamethoxazole are effective. For resistant strains, fluoroquinolones or cephalosporins are used. For gastroenteritis, treatment is usually symptomatic only. Severely ill or those with suspected bacteremia are treated with trimethoprim-sulfamethoxazole, ampicillin, or ciprofloxacin. In addition, abscesses should be drained.

Prognosis: The mortality rate of typhoid fever is about 2% in treated cases. Elderly or debilitated persons are likely to do poorly. With complications, the prognosis is poor. Relapses occur in up to 15% of cases. A residual carrier state frequently persists. For gastroenteritis, prognosis is good since it is usually self-limited.

Reporting Requirement: Reportable to local health department in Arizona and to the CDC.

Streptococcosis

Agent: *Streptococcus suis* type 2; facultative anaerobic gram-positive coccoid-shaped bacteria.

Animal Reservoir:

Hosts: Pigs.

Disease: Asymptomatic to severe disease; septicemia; arthritis, polyserositis, meningitis, endocarditis; pneumonia; abortions; abscessation.

Detection: Culture of tonsil swab specimens; detection of IgG antibodies by use of ELISA.

Control: Good programs of sanitation.

Mode of transmission: Direct contact with pigs mainly through skin abrasions or cuts. At highest risk are farm workers, butchers, abattoir workers, veterinarians, and those handling pork products.

Communicability: Low.

Reporting Requirement: Not reportable.

Humans:

Occurrence: In The Netherlands, the prevalence of antibodies to *S. suis* among pig farmers was two of 190 (1%) whereas veterinarians had a prevalence of six of 100 (6%). The estimated annual risk of developing *S. suis* meningitis in Dutch abattoir workers and pig breeders was three of 100,000. In New Zealand, 0 of 16 (0%) veterinary students, 11 of 107 (10%) meat inspectors, and 15 of 70 (21%) pig farmers had antibodies. The annual incidence of seroconversion in pig farmers was estimated at 28%. A comparison of 30 cases in The Netherlands and 30 cases reported in literature indicated that 50 (83%) were employed in the pig industry.

Clinical syndromes: Septicemia, meningitis, arthritis, endocarditis, endophthalmitis; deafness and ataxia are frequent sequelae of meningitis.

Incubation period: Unknown, probably one day to three days.

Diagnosis: Culture; isolation of viridans streptococci or Group-D *Streptococcus* should arouse suspicion of *S. suis* infection in cases with pig exposure.

Prevention: PPE, including gloves; sanitation.

Treatment: Antimicrobials (e.g., penicillin); supportive care.

Reporting Requirement: Not reportable.

Toxoplasmosis

Agent: *Toxoplasma gondii*; intracellular coccidian protozoa.

Animal Reservoir:

Hosts: Cats (definitive host); mice, rats, dogs, cattle, sheep, goats, pigs, chickens (intermediate hosts).

Disease: Asymptomatic in adult cats, but occasionally vomiting, diarrhea, dyspnea, coughing, anorexia, uveitis, pancreatitis, especially in young or immunocompromised cats; hepatic necrosis in dogs; abortions and stillbirths in sheep, goats, and pigs.

Detection: In cats, fecal examination for oocysts; isolation of tachyzoites (rapidly multiplying form of organism) from CSF or aqueous humor. There are no practical methods to detect the presence of bradyzoites (slowly multiplying form of organism) encysted in tissues (e.g., brain, liver, and skeletal and cardiac muscle) of intermediate hosts. Serologic testing: ELISA, IFA test.

Control: Prevent exposure of cats to potentially contaminated meat by feeding only commercially processed cat food; dispose of cat feces daily before oocysts sporulate and become infective; house cats indoors and apart from other species; antimicrobials (e.g., clindamycin) for dogs and cats; acquisition of cats from *T. gondii*-free sources.

Mode of transmission: A 2005 survey of physicians conducted by the Humane Society of the US revealed that physicians in the USA continue to promote pet cats as the major source of toxoplasmosis infection in pregnant women despite evidence that they are more likely to contract the disease from eating raw or undercooked meat and from gardening without wearing gloves. Human infection results (1) from ingestion of cysts in raw or undercooked meat; (2) from ingestion of oocysts in contaminated food or water, by careless handling of contaminated cat litter, or from soil by soil-eating children; (3) from transplacental transmission; or (4) from direct inoculation via blood transfusions or organ transplants. Intermediate hosts can become lifelong carriers of infection due to encysted bradyzoites.

Communicability: Low; oocysts shed from cats become infective within 12 hours to several days and may remain viable in water or soil for more than 12 months.

Reporting Requirement: Not reportable.

Humans:

Occurrence: The prevalence of *Toxoplasma* antibodies in veterinarians was similar to that of other occupational groups. High prevalence of *Toxoplasma* antibodies among animal technicians has been reported, but was attributed to their exposure outside of occupational settings. Comparison of the prevalence of *Toxoplasma* antibodies in employees with exposure to cats at a research institution revealed no increase in risk of infection.

Clinical syndromes: 80% are asymptomatic. Mild flu-like illness; can develop more severe clinical signs of disease, including fever, lymphadenopathy, pneumonia, chorioretinitis, and rashes. Immunosuppressed individuals can develop focal lesions of encephalitis following reactivation of bradyzoites. Infections in pregnant women can lead to birth defects, chorioretinitis, blindness, and severe neurologic sequelae, with mental retardation in infants.

Incubation period: 1-2 weeks.

Diagnosis: Detection of increase in titer between acute and convalescent serum samples via Sabin-Feldman dye test, indirect hemagglutination, IFA, ELISA, Western blot, PCR, or IgG avidity; isolation of *T. gondii* tachyzoites from blood, tissue, or body fluids.

Prevention: Irradiated meat or meat cooked to 66°C (151°F) kills cysts in tissues. Hands, kitchen surfaces, and cooking utensils must be thoroughly cleaned with soap and water after contact with raw meat. Children's play areas, including sandboxes, should be protected from cat (and dog) feces; hand washing is indicated after contact with soil potentially contaminated by animal feces. Indoor cats should be fed only dry, canned, or cooked meat. Litter boxes should be changed daily as freshly deposited oocysts are not infective for 48 hours. PPE, including gloves, good hygiene when handling potentially infective material. Pregnant women can have their serum examined for antibody. If negative, preventive measures such as having no further contact with cats and cat litter, thorough cooking of meat, handwashing after handling raw meat and before eating and wearing gloves when gardening, and thorough washing of vegetables should be taken.

Treatment: Not routinely indicated for immunocompetent individuals; antimicrobial therapy (e.g., sulfadiazine and pyrimethamine) for immunosuppressed persons manifesting specific symptoms.

Prognosis: Excellent for immunocompetent and fatal for immunosuppressed people not receiving treatment.

Reporting Requirement: Not reportable.

Tuberculosis

(Humans: Consumption)

Agent: *Mycobacterium avium* complex, *M. bovis*, *M. tuberculosis*; acid-fast rod-shaped bacteria.

Animal Reservoir:

Hosts: *Mycobacterium avium*, *M. bovis*, *M. tuberculosis*—macaques, baboons, squirrel monkeys, and other nonhuman primates. These agents do not occur naturally in monkeys, but are acquired from humans or other species (*M. bovis*), or directly from environmental sources, such as soil and water (*M. avium*). Transmission occurs between monkeys, with secondary spread back to humans. *Mycobacterium paratuberculosis*, the causative agent of Johne's disease, has been recognized in one species of macaque, and is a suspected zoonotic agent. *M. bovis*, *M. tuberculosis*—dogs, cats, pigs; *M. bovis*—cattle, sheep, goats; *M. avium*—pigs, chickens, pigeons.

Disease: Asymptomatic to sudden death; pulmonary disease, anorexia, chronic weight loss; peripheral lymphadenopathy, with or without chronic draining tracts to the skin; cutaneous abscesses; nodular lesions may form in multiple organs, including gastrointestinal tract, vertebrae, brain and spinal cord.

Detection: Intradermal tuberculin skin test (Mantoux test); thoracic radiography; gross and histologic examination of tissues; ELISA; PCR assay. False-negative skin test results may occur due to concurrent disease, early stage disease, or immunosuppression, requiring repeated testing during quarantine and thereafter. Culture usually takes four to eight weeks for confirmation.

Control: Testing and elimination of infected animals; rigorous quarantine programs for arriving animals; continuous tuberculosis surveillance; good sanitation programs.

Mode of transmission: For *M. tuberculosis*, exposure is via airborne spread from people sneezing or coughing. For *M. bovis*, via ingestion of unpasteurized dairy products or airborne spread from infected cattle to farmers and animal handlers. For *M. avium*, via fecal-oral via water contamination.

Communicability: Moderate, depending on the host species.

Reporting Requirement: Reportable to the USDA's Veterinary Services National Animal Health Program.

Humans:

Occurrence: Cases have followed occupational exposure to infected nonhuman primates in research settings. New diagnostic technologies such as DNA fingerprinting suggest that as many as 1/3

of new cases of tuberculosis in urban populations are primary infections resulting from person-to-person transmission. Prior to this finding, it was thought that most cases of active TB were as a result of activation of latent disease.

Clinical syndromes: The patient with pulmonary TB typically presents with slowly progressive symptoms of malaise, anorexia, weight loss, fever, and night sweats. Chronic coughing is the most common symptom. Pulmonary, meningeal, visceral organs, and other body systems can be involved; chronic cough, fatigue, fever, weight loss, and hemoptysis during advanced stages of pulmonary disease. Lifelong latent (non-progressive) infections within calcified pulmonary nodules also occur. Crohn's disease is linked to *M. paratuberculosis* infection.

Incubation period: Ranges from two to 10 weeks for development of primary lesions or skin test-positivity.

Diagnosis: May perform dual Mantoux tests (using avian and human precipitin) due to false-negative reactions for non-tuberculous mycobacteria with the use of only the human Mantoux; PCR assay; RT-PCR assay; pulmonary radiography; acid-fast stain of sputum samples.

Prevention: PPE, including respiratory tract protection; good hygiene; appropriate animal restraint; separate animal facilities from human work areas; semiannual tuberculin testing for facility personnel. Millions of individuals worldwide have been vaccinated with BCG but it is not generally given in the US because of the low prevalence of TB, the vaccine's interference with the ability to determine latent TB using TST, and its variable effectiveness against pulmonary TB.

Treatment: Nonadherence to antituberculous treatment is a major cause of treatment failure, continued transmission of tuberculosis, and the development of drug resistance. Most patients with previously untreated pulmonary TB can be effectively treated with either a 6-month or a 9-month regimen. The initial phase of a 6-month program consists of daily isoniazid, rifampin, pyrazinamide, and ethambutol. Treatment is adjusted based on culture results.

Prognosis: Almost all properly treated patients with TB can be cured. Relapse rates are less than 5% with current regimens. The main cause of treatment failure is nonadherence to therapy.

Reporting Requirement: Reportable to local health department in Arizona and to the CDC.

Tularemia

(Francis' disease, deer-fly fever, rabbit fever, O'Hara disease)

Agent: *Francisella tularensis*, a highly pleomorphic, small, aerobic, gram-negative, nonmotile rod or coccobacillus less than 1 micron that can survive several weeks in the external environment.

Animal Reservoir:

Hosts: Wild rodents and rabbits. Hamster and prairie dogs may carry the organism.

Disease: Clinical signs usually occur alongside heavy infestation with ticks, and include sudden high fever, anorexia, and stiffness, eventually leading to prostration and death. In sheep, pregnant ewes may abort. Affected dogs have soft nodular swellings under the skin. Miliary foci of necrosis occur in the liver, spleen, and lymph nodes. Severe lesions in the lung involve widespread consolidation with edema and pleurisy.

Detection: Culture and serologic testing: IFA or agglutination test.

Control: Control is difficult and is limited to tick control and to rapid diagnosis and treatment.

Mode of transmission: (1) handling tissue of infected animals (direct contact with UNBROKEN skin is sufficient); (2) human infections due to a cat bite and scratch and a NHP bite also reported; (3) transmitted by biting insects; (4) inhalation, ingestion.

Communicability: All ages are susceptible, and long-term immunity follows recovery; reinfection is rare and has been reported in only laboratory staff.

Reporting Requirement: Not reportable.

Humans:

Occurrence: Approximately 200 cases of tularemia in humans are reported annually in the United States, mostly in persons living in the south-central and western states. Tularemia is an occupational risk for farmers, foresters, and veterinarians, and is listed by the US Centers

for Disease Control and Prevention (CDC) as one of the six category A, or high-priority, biological warfare agents.

Clinical syndromes: Fever, headache, nausea, and prostration. Papule progressing to ulcer at site of inoculation.

Incubation period: 2-10 days.

Diagnosis: Serologic testing: Agglutination test. Culturing requires special media and for this reason and because culturing may be hazardous to laboratory personnel, the diagnosis is usually made serologically.

Prevention: Avoid tick, fly, and mosquito bites; avoid contact with untreated water; use impervious gloves when skinning or handling animals; cook meat thoroughly; wear face masks, impervious gloves, and use biosafety cabinets when performing laboratory cultures.

Treatment: Streptomycin is drug of choice.

Prognosis: The mortality rate for untreated cases is 5-7%.

Reporting Requirement: Reportable to local health department in Arizona and to the CDC.

Viral Hepatitis

Agent: Hepatitis A virus, a RNA hepatovirus in the picornavirus family.

Animal Reservoir:

Hosts: Humans, rarely nonhuman primates.

Disease: Asymptomatic.

Detection: Serologic testing for specific antibodies, using ELISA.

Control: Vaccinate monkeys with Havrix® (GlaxoSmithKline) 360 units IM, repeat in 6 months, check for positive titer one month later.

Mode of transmission: Fecal-oral. Spread is favored by overcrowding and poor sanitation. Common source is from contaminated food or water.

Communicability: Low in biomedical settings due to required quarantining and testing of nonhuman primates.

Reporting Requirement: Not reportable.

Humans:

Occurrence: In the US, about 30% of the population has serologic evidence of previous infection. A large outbreak among patrons of a restaurant in Monaca, Pennsylvania in 2003 was traced to contaminated green onions from Mexico. One case of transmission from pigtailed macaques to a cage washer occurred at the University of Arizona approximately 10 years ago. **Clinical syndromes:** Prodrome of anorexia, nausea, vomiting, malaise. Fever, enlarged and tender liver, jaundice may develop 5-10 days later.

Incubation period: 30 days.

Diagnosis: Detection of IgM anti-HAV is an excellent test for diagnosing HAV since antibody occurs early in the course of the disease.

Prevention: Handwashing; thorough cleaning of utensils and bedding. Two effective inactivated hepatitis A vaccines are available.

Treatment: Bed rest is recommended if symptoms are marked; 10% glucose given IV if there is pronounced nausea and vomiting. Dietary management consists of palatable meals as tolerated. Avoid strenuous physical exertion, alcohol, and hepatotoxic agents. Corticosteroids should be avoided.

Prognosis: In most patients, clinical recovery is complete in 3-6 weeks. The mortality rate is less than 0.2%.

Reporting Requirement: Reportable to local health department in Arizona and to the CDC.

Glossary

Abattoir - A slaughterhouse

Aerophobia - An unusual fear of drafts of air

Agglutination - The process by which suspended bacteria, cells, or other particles are caused to adhere and form into clumps; similar to precipitation, but the particles are larger and are in suspension rather than being in solution

Airsacculitis - [Inflammation](#) of the [mucous membrane](#) of the [air sacs](#) of [birds](#)

Alopecia - Loss or the absence of hair, especially from the human head

Amniotic - Of or pertaining to the [amnion](#); characterized by an amnion; as, the [amniotic fluid](#); the [amniotic sac](#)

Antigen - A substance, usually a protein, on the surface of a cell or bacterium that stimulates the production of an antibody

Antimicrobial - Tending to destroy microbes, to prevent their multiplication or growth, or to prevent their pathogenic action

Aqueous Humor - The transparent fluid that circulates in the eye chamber between the back of the cornea and the front of the iris and pupil and permeates the vitreous humor behind the lens

Arthralgia - Pain in a joint

Arthropod - An invertebrate animal that has jointed limbs, a segmented body, and an exoskeleton made of chitin, e.g. an insect, arachnid, centipede, or crustacean

Asplenic - Having no spleen

Asymptomatic - Not showing or producing indications of a disease or other medical condition

Ataxia - The inability to coordinate the movements of muscles

Athymic - Lacking a [thymus gland](#) (A [lymphoid](#) organ situated in the center of the upper chest just behind the [sternum](#) (breastbone). It is in the thymus that [lymphocytes](#) mature, multiply, and become [T cells](#))

Atrophic - A [wasting](#) away, a diminution in the [size](#) of a [cell](#), [tissue](#), [organ](#) or [part](#)

Axillary - Relating to or near the armpit

Bacillary Angiomatosis - A skin disease characterized by raised, red lesions, caused by bacterial infection in individuals with weakened immune systems, and treatable with antibiotics, although potentially fatal if untreated.

Bacteremia - The presence of bacteria in the blood

Bradyzoite - A sessile (slow-growing), form of a [zoonotic microorganism](#), typically, [Toxoplasma gondii](#), including others responsible for [parasitic](#) infections. In chronic (latent) [toxoplasmosis](#), bradyzoite

microscopically presents as clusters enclosed by an irregular crescent-shaped wall (a [pseudocyst](#)), in infected muscle and brain tissues. **Bradyzoite** is the antonym of [tachyzoite](#), which is a stage of rapid growth.

Bubo - A tender, enlarged, and inflamed lymph node, particularly in the armpit or groin.

Catarrhal - Inflammation of a mucous membrane; *especially*: one chronically affecting the human nose and air passages

Cellulitis - Infection and inflammation of the tissues beneath the skin

Cervical - Relating to a neck, or cervix, in any sense

Choanal - Pertaining to the choana, the passageway from the back of one side of the nose to the throat. The choana is shaped like an inverted funnel which opens into the upper throat. The choanae must be open to permit breathing through the nose

Chorioretinitis - An inflammation of the [choroid](#) and [retina](#) of the eye. The symptoms are the presence of [floating black spots](#) and blurry vision

Ciliated - Provided with cilia or with a fringe of hairs

Cloacal - Pertaining to the [cloaca](#) (A common [passage](#) for [faecal](#), [urinary](#) and [reproductive discharge](#) in most lower [vertebrates](#))

Colostrum - A yellowish fluid rich in antibodies and minerals that a mother's breasts produce after giving birth and before the production of true milk. It provides newborns with immunity to infections

Complement-Fixation (CF) - A diagnostic test in which serum drawn from the animal or human is mixed with antiserum containing antigen in the presence of complement, which causes the lysis of antibody coated sheep red cells. Lack of hemolysis indicates a positive test result

Congenital - Existing at birth, referring to certain mental or physical traits, anomalies, malformations, diseases, etc. which may be either hereditary or due to an influence occurring during gestation up to the moment of birth

Conjunctiva - The mucous membrane investing the anterior surface of the eyeball and the posterior surface of the lids

Coronet - The [line](#) of [junction](#) between the [skin](#) and the [hoof](#) or [claw](#)

Cull - When people cull animals, they kill them, especially the weaker members of a particular group of them, in order to reduce or limit their number

Cutaneous - Relating to the skin

Cyanosis - A condition in which the skin and mucous membranes take on a bluish color because there is not enough oxygen in the blood

Cysts - A round growth, just under the skin or deeper in the body, which contains liquid

Dams - A [female parent](#); used of beasts, especially of [quadrupeds](#)

Definitive Host - The plant or animal in or on which a parasitic organism reaches sexual maturity

Dermatitis - Inflammation of the skin from any cause, resulting in a range of symptoms such as redness, swelling, itching, or blistering

Discospondylitis - Inflammation of intervertebral disks in animals, often with osteomyelitis of adjacent vertebrae, caused by a bacterial infection or occasionally trauma. Resultant compression of the spinal cord can cause paralysis. It is most commonly seen in adult dogs but also affects pigs, horses, and cattle

Disequilibrium - A state of instability or imbalance

Duodenum - The first short section of the small intestine immediately beyond the stomach

Dysentery - A disease marked by frequent watery stools, often with blood and mucus, and characterized clinically by pain, tenesmus, fever, and dehydration

Dyspnea - Difficult or labored breathing; shortness of breath

Ectoparasitism - A parasite, such as a flea, that lives on the exterior of another organism

Eczema - An inflammation of the skin characterized by reddening and itching and the formation of scaly or crusty patches that may leak fluid

Edema - An accumulation of an excessive amount of watery fluid in cells or intercellular tissues

ELISA (Abbreviation for enzyme-linked immunosorbent assay) - A widely used technique for determining the presence or amount of protein in a biological sample, using an enzyme that bonds to an antibody or antigen and causes a color change

Endemic - Denoting a temporal pattern of disease occurrence in a population in which the disease occurs with predictable regularity with only relatively minor fluctuations in its frequency over time

Endocarditis - Inflammation of the thin membranous lining endocardium of the heart's cavities

Endophthalmitis - Inflammation of the ocular cavities, caused by infection, trauma, or allergic reaction

Enterocolitis - Inflammation of the small and large intestine as a result of infection

Epididymitis - Inflammation of the epididymis ([Convoluted tubule](#) connecting the [vas efferens](#), that [comes](#) from the [seminiferous tubules](#) of the mammalian [testis](#), to the [vas deferens](#). [Maturation](#) and [storage](#) of [sperm](#) occur in the epididymis)

Erythema - Redness of the skin as a result of a widening of the small blood vessels near its surface. It has various causes, including fever and inflammation

Exanthema - A skin eruption occurring as a symptom of an acute viral or coccal disease, as in scarlet fever or measles

Facultative - Able to live under more than one specific set of environmental conditions; possessing an alternative pathway

Flagellate - A microorganism with long thin cellular appendages flagella. Some flagellates are pathogenic parasites that cause diseases such as giardiasis in humans

Flatulence - Presence of an excessive amount of gas in the stomach and intestines

Fomites - Inanimate objects capable of carrying germs from an infected person to another person

Fulminating - Running a rapid course, worsening quickly

Gastroenteritis - Inflammation of the mucous membrane of both stomach and intestine

Genital - Relating to the external sexual organs or to reproduction

Genitourinary - Relating to or affecting the genital and urinary organs

Genomic - The total genetic content contained in a haploid set of chromosomes in eukaryotes, in a single chromosome in bacteria, or in the DNA or RNA of viruses.

Glottis - The long opening between the vocal cords at the upper part of a vertebrate's windpipe larynx

Granulomatous - A mass or nodule of chronically inflamed tissue with [granulations](#) that is usually associated with an infective process

Hemoglobinuria - The presence of free hemoglobin in the urine, an abnormal finding, that may make the urine look dark. [Hemoglobin](#) is the [protein](#) in the [red blood cells](#) which carries oxygen from the lungs to the tissues of the body and returns carbon dioxide from the tissues to the lungs. The [iron](#) contained in hemoglobin gives [red blood cells](#) their characteristic color

Hematuria - The presence of blood in the urine

Hemolytic - Destructive to blood cells, resulting in liberation of hemoglobin

Hemoptysis - The coughing up of blood or mucus containing blood

Hepatic - Relating to or affecting the liver

Hepatosplenomegaly - Enlargement of the liver and the spleen

Hepatotoxic - Any substance which is [toxic](#) to the liver

Heterogeneity - The [condition](#) or [state](#) of [being](#) different in kind or [nature](#)

Hilar - A depression or pit at the part of an organ where structures such as [blood vessels](#) and [nerves](#) enter

Histologic - A branch of anatomy that deals with the minute structure of animal and plant tissues as discernible with the microscope

Histiocytic - A Histiocyte is a [cell](#) that is part of the human [immune system](#). All categories of Histiocytes are derived from the [bone marrow](#) by multiplication from a [stem cell](#). The derived cells migrate from the bone marrow to the blood as [monocytes](#). They circulate through the body and stop in various organs where they undergo differentiation into histiocytes which are part of the [mononuclear phagocyte system](#)

Hydrophobia - An extremely intense aversion to water, especially the fear of drinking water or other liquids

Iatrogenic - Denoting response to medical or surgical treatment, induced by the treatment itself; usually used for unfavorable responses

Icterohemorrhagic - A mixture of icterus and hemolysis

Icterus - Yellowish discoloration of the whites of the eyes, skin, and mucous membranes caused by deposition of bile salts in these tissues

Incubation Period - The period between the time somebody is infected with a disease and the appearance of its first symptoms

Indurated - Hardened, usually used with reference to soft tissues becoming extremely firm but not as hard as bone

Jejunum - The section of the small intestine situated between the duodenum and the ileum, whose main function is the absorption of nutrients from digested food

Keratitis - [Inflammation](#) of the [cornea](#)

Keratoconjunctivitis - Combined inflammation of the cornea and conjunctiva

Laryngeal - Belonging to, relating to, situated in, or affecting the larynx

Lingual - Relating to the tongue or any tongue like part; Next to or toward the tongue

Lumen - The space in the interior of a tubular structure, such as an artery or the intestine

Lymphadenopathy - Any disease process affecting a lymph node or lymph nodes

Malaise - A general feeling of illness or sickness of no diagnostic significance

Metacestodes - The larval stages of a tapeworm, including the metamorphosis of the oncosphere to the first evidence of sexuality in the adult worm, differentiation of the scolex, and beginning of proglottid formation; it includes the proceroid and plerocercoid stages of pseudophyllid cestodes, and the cysticercus, cysticercoid, coenurus, and hydatid stages of cyclophyllidean cestodes

Microscopy - Investigation of minute objects by means of a microscope

Miliary - Resembling a millet seed in size (about 2 mm)
Marked by the presence of nodules of millet seed size on any surface

Morphologically - The branch of biology that deals with the form and structure of organisms without consideration of function

Mortality - Death or the number of deaths

Mucosal - Of or relating to mucous membranes

Mucosa - A mucous tissue lining various tubular structures, consisting of epithelium, lamina, propria, and, in the digestive tract, a layer of smooth muscle

Myalgia - Pain or tenderness in a muscle or group of muscles

Myelitis - Inflammation of the spinal cord or bone marrow

Myocarditis - Acute or chronic inflammation of the heart muscle

Nares - The [nostrils](#) or [nasal openings](#), the [anterior](#) nares [being](#) the [external](#) or [proper](#) nostrils, and the [posterior](#) nares, the openings of the nasal [cavities](#) into the [mouth](#) or [pharynx](#)

Necrosis - The death of cells in a tissue or organ caused by disease or injury

Nematodes - Any of several worms of the phylum Nematoda, having unsegmented, cylindrical bodies, often narrowing at each end, and including parasitic forms such as the hookworm and pinworm. Also called roundworm

Neonatal - Relating to the period immediately succeeding birth and continuing through the first 28 days of extrauterine life

Neonates - A newborn infant, especially one less than four weeks old

Nephropathy - A disease or medical disorder of the kidney

Neuroteratogen - Any agent or factor that induces or increases the incidence of defects in the nervous system or brain of the developing embryo.

Ocular - Relating to, perceived by, or performed by the eye

Offal - The edible, mainly internal organs of an animal

Oocyst - A fertilized gamete of sporozoan: a fertilized gamete of parasitic organisms' sporozoans that is enclosed in a thick wall

Orchitis - Inflammation of the testis

Oropharynges - The part of the pharynx between the soft palate and the epiglottis

Osteomyelitis - Inflammation of the bone marrow and adjacent bone

Palatable - Food or drink that has a pleasant taste

Papule - A small hard round protuberance on the skin

Parenteral - Describes drug administration other than by the mouth or the rectum, e.g. by injection, infusion, or implantation

Parthenogenetic - Reproduction by development of an unfertilized usually female gamete that occurs especially among lower plants and invertebrate animals

Parturient - Relating to the process or time of childbirth

Pathogens - Any small organism, such as a virus or a [bacterium](#) which can cause disease

PCR - Abbreviation for polymerase chain reaction

Peliosis Hepatis - The presence throughout the liver of blood-filled cavities that may become lined by endothelium or become organized

Peripherally - Of, relating to, involving, or forming a [periphery](#) or surface part

Peritonitis - Inflammation of the membrane that lines the abdomen peritoneum. Symptoms can include swelling of the abdomen, severe pain, and weight loss

Petechiation - The state of being covered with petechiae <spotty *petechiation* of the intestinal mucosa

Photophobia - very low tolerance of the eye for light, sometimes a symptom of disease or migraine; An irrational fear and avoidance of light or lighted spaces

Pleocytosis - Presence of a greater than normal number of cells in the cerebrospinal fluid

Pleomorphic - This term refers to cells that vary in their size, shape, and inside structure

Pleurisy - Inflammation of the membrane pleura surrounding the lungs, usually involving painful breathing, coughing, and the buildup of fluid in the pleural cavity

Polyserositis - Chronic inflammation of several serous membranes with effusions in serous cavities resulting in fibrous thickening of the serosa and constrictive pericarditis

Pock - A pustule

Prodromal - An early symptom indicating the onset of an attack or a disease

Prolapse - A sinking of an organ or other part, especially its appearance at a natural or artificial orifice

Prophylactic - Protecting against infection or disease

Prostatitis - Inflammation of the prostate gland

Prostration - A marked loss of strength, as in exhaustion

Protozoa - Any of various types of very small, usually single-celled animal which do not have a spine

Pruritus - An intense feeling of itchiness

Purpura Fulminans - A severe and fatal form of idiopathic thrombocytopenic purpura that occurs especially in children, usually following an infectious illness, and that is characterized by low blood pressure, fever, and disseminated intravascular coagulation.

Purulent - Relating to, containing, or consisting of pus

Pyoderma - A skin infection causing the development of pus or pustules

Reservoir - An alternate or passive host or carrier that harbors pathogenic organisms, without injury to itself, and serves as a source from which other individuals can be infected

Rhinitis - Inflammation of the nasal mucous membrane

Ruminants - Any of various hoofed, even-toed, usually horned mammals of the suborder Ruminantia, such as cattle, sheep, goats, deer, and giraffes, characteristically having a stomach divided into four compartments and chewing a cud consisting of regurgitated, partially digested food.

Salpingitis - Inflammation of the uterine tube or inflammation of the auditory tube

Saprophytic - Obtaining nourishment from the products of organic breakdown and decay

Scarification - The making of a [number](#) of [superficial incisions](#) in the [skin](#)

Sepsis - The condition or syndrome caused by the presence of microorganisms or their toxins in the tissue or the bloodstream

Septicemia - Body-wide disease caused by microorganisms or their toxins in the blood. Also called blood poisoning

Sequelae - A pathological condition resulting from a [disease](#), [injury](#), or other [trauma](#)

Serotype (serovar) - A taxonomic subdivision of bacteria based on the kinds and combinations of constituent antigens present in the cell

Serpiginous - Creeping; denoting an ulcer or other cutaneous lesion that extends with an arciform border; the margin has a wavy or serpent-like border.

Shorn - With hair cut short

Spirochete - A microscopic bacterial organism in the Spirochaeta family. Spirochetes have a worm-like, spiral-shaped form, and wiggle vigorously when viewed under a microscope

Splenectomy - Surgical removal of the spleen

Sporulate - To produce or release spores

Sputum - A substance coughed up from the respiratory tract and usually ejected by mouth, e.g. saliva, phlegm, or mucus

Stellate - Shaped like a star and arranged as a rosette.

Strobilar - A part or structure that buds to form a series of segments, as the main body part of a tapeworm or the polyp stage in certain jellyfish

Sylvatic - Occurring in or affecting [wild animals](#)

Tachycardia - An excessively rapid heartbeat, typically regarded as a heart rate exceeding 100 beats per minute in a resting adult

Tachypnea - Unusually fast breathing, generally considered to be over 20 breaths per minute in a resting adult

Tamponade - The insertion of a tampon during surgery to check bleeding

Teats - The raised part of the female breast of a mammal through which an animal takes its mother's milk; a [nipple](#)

Tenesmus - A painful spasm of the urogenital diaphragm with an urgent desire to evacuate the bowel or bladder, involuntary straining, and the passage of little fecal matter or urine

Teratogenic - Of, relating to, or causing malformations of an embryo or fetus

Thrombophlebitis - Inflammation of a vein with the formation of a blood clot

Trophozoites - A protozoan, especially of the class Sporozoa, in the active stage of its life cycle

Ungulates - A mammal with hooves

Urticarial - A [transient condition](#) of the [skin](#), usually caused by an [allergic reaction](#), characterized by pale or reddened [irregular](#), elevated patches and severe [itching](#), [hives](#)

Uveitis - Inflammation of the uvea of the eye

Vascular - Composed of, containing, or having to do with tubes or ducts that carry a fluid, such as blood or lymph in animals or sap in plants, or with a system of such tubes or ducts

Vesicle - A small circumscribed elevation in the skin containing clear fluid.

Virulence - The ability of any agent of [infection](#) to produce [disease](#). The virulence of a microorganism (such as a bacterium or virus) is a measure of the severity of the disease it is capable of causing

Viscera - The internal organs of the body, especially those of the abdomen such as the intestines

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Zoonotic Diseases of Research Animals Quiz (Version 2007A)

Your Name(print): _____ Department: _____

Employee ID# _____ Investigator: _____ Lab phone: _____

E-mail: _____ Confirm I passed (Must provide email address) _____

CERTIFICATION NOT GIVEN IF INFORMATION IS NOT READABLE OR INCOMPLETE

In order to become certified, you may miss FIVE or less questions. The notes may be consulted when answering this quiz. Please circle the "T" if "true", or the "F" if "false".

1. T F The World Health Organization defines zoonoses as diseases and infections, which are naturally transmitted between vertebrate animals and man.
2. T F Mode of transmission include exposure to: feces, urine, saliva, blood, and milk.
3. T F Probability of disease transmission from animals to man is influenced by several factors including population density of the animals in the colony.
4. T F Emerging zoonoses does not include new animal diseases with an unknown host spectrum.
5. T F Natural animal reservoirs represent a less frequent source of new agents of human disease than the sudden appearance of a completely new agent.
6. T F Agent is the specific pathogen(s) that cause the disease.
7. T F Animal reservoir section includes the invertebrates in which the infective agent resides, and is subdivided into four categories: hosts, disease, detection and control.
8. T F Hosts are the animal sources of the specific pathogen(s) that cause the disease.
9. T F Disease describes the clinical manifestations, if any, that are manifested in the human hosts.
10. T F Detection describes how the infection may be diagnosed in the hosts.
11. T F Control includes methods by which infection in the host(s) can be prevented, treated, or eradicated.
12. T F Mode of transmission is the means by which the agent spreads from the reservoir host to humans.
13. T F Communicability is a general assessment of the agent's infectivity and the relative ease with which the agent may be transmitted to humans.
14. T F Occurrence provides brief information on documented cases and includes the source of the infection and some characteristics of the affected persons.
15. T F Clinical syndromes describe the principal clinical features of the disease, including those reported in documented cases.
16. T F Incubation period is the time between exposure to the agent and the appearance of clinical signs of disease in animals.
17. T F Prevention provides information on measures used to maximize exposure and disease in humans.
18. T F Reporting requirement under the animal reservoir section are those diseases required to be reported to the United States Department of Agriculture, if diagnosed in animals.
19. T F Amebic Dysentery, Amebiosis, found in macaques, baboons, squirrel monkeys, and other nonhuman primates; occasionally dogs and cats, is reportable to local health department in Arizona.
20. T F Cats are the natural host for Amebiosis and is the usual source of infection for humans.
21. T F B Virus is taught as a separate class for those working with Macaque nonhuman primates.
22. T F Humans have a natural resistance to balantidiasis which is found in pigs, but can be prevented with good hygiene and strict sanitation.

23. T F Brucellosis or contagious abortion is carried in sheep, goats, pigs and dogs and is very common in the US.
24. T F Campylobacteriosis, enteritis, is carried mainly in horses and is rampant even with proper sanitation.
25. T F Capnocytophagosis is carried by dogs, cats and rodents. No known cases have been reported in animal facilities; however, multiple reports of transmission to humans from pets exist.
26. T F Cat Scratch Disease is principally spread by fleas among cats; however, flea-to-human transmission is unlikely. Infection typically occurs after bites or scratches from healthy young pet cats and occasionally dogs.
27. T F Chlamydiosis is found in sheep, goats, dogs, cats, guinea pigs and frogs. Only the kind communicated by sheep and goats is dangerous to human women.
28. T F Colibacillosis, white scours, is most often found in rodents.
29. T F Cryptosporidiosis is carried by cats, dogs, macaques, baboons, squirrel monkeys, and other nonhuman primates, cattle, sheep, pigs, ferrets, chickens; frogs; rodents. Agent causes no clinical syndrome even in immunocompromised individuals and is not reportable in AZ or to the CDC.
30. T F Dermatophytosis, ringworm or athlete's foot, is carried by guinea pigs, rabbits, cats, dogs, non-human primates and some livestock. Disease can cause flat, spreading, ring-shaped lesions in the skin.
31. T F Dogs are the definitive host and sheep, cattle and other domestic livestock are intermediate hosts of Echinococcosis. Domestic dogs and cats become infected when they eat infected wild rodents.
32. T F Ectoparasitism is found in cats, dogs, rabbits, rodents, and other common laboratory animal species may occasionally be infested with these arthropod agents. There have been several reports of ectoparasitism among animal husbandry and research technicians in laboratory animal care settings. Recognition of animal infestations has sometimes initially been prompted by medical complaints from staff members or pet owners.
33. T F Erysipelas is found in pigs, chickens and sheep. Risk of cutaneous infection increases if animal handlers have unprotected cuts or abrasions on hands and can cause cellulitis, fever and septic arthritis.
34. T F Giardiasis is found in most domestic and wild mammals, birds and humans. Infection is uncommon.
35. T F Hantaviral Diseases is carried in rats, mice and other wild rodents. Virus shed in urine, feces, and saliva of persistently infected rodents for months; inhalation of infective aerosols from rodent excreta; wound contamination, conjunctival exposure, ingestion. If rodent trapping, Risk Management and Safety has a mandatory training requirement.
36. T F Leptospirosis is carried in many species. Without jaundice, the disease is almost **always** fatal.
37. T F Lymphocytic Choriomeningitis is found in rodents, dogs, pigs and monkeys. Contaminated tumors or cell lines are the usual source of LCMV in laboratory outbreaks. Transmission to humans by parenteral inoculation, ingestion, inhalation, and splash contamination of mucous membranes with infective secretions.
38. T F Orf is found mainly in rodents and is transmitted to humans through direct contact with mucous membranes of infected animals, and with with udders of nursing dams.
39. T F Pasteurellosis is found in cats, rabbits, dogs and pigs. Infection causes almost no symptoms in humans so there is no need for special procedures.
40. T F Plague is carried in wild rodents. It is transmitted among rodents and to humans by the bites of fleas or direct contact. The patient with pneumonia can transmit the infection to others by droplets. When pneumonia or meningitis develops, the outcome is often fatal.
41. T F Q Fever is carried by cattle, sheep and goats. Occupational exposure is highly linked to the risk of acquiring infection from animals. In research facilities, if sheep are properly screened for infection, the risk is substantially higher.

42. T F Rabies is possible in most mammals. Rodents and lagomorphs are unlikely to have rabies because they cannot survive the disease long enough to transmit it. Once the symptoms have appeared, death almost inevitably occurs after 7 days, usually from respiratory failure.
43. T F Rat Bite Fever is found in rodents, and sometimes in cats and primates. Without treatment, the mortality rate is extremely high.
44. T F Salmonella typhi causes Typhoid Fever. The mortality rate of typhoid fever is about 2% in treated cases. Elderly or debilitated persons are likely to do poorly. With complications, the prognosis is poor. Relapses occur in up to 15% of cases. A residual carrier state frequently persists.
45. T F Streptococcosis is transmitted to humans through direct contact with pigs mainly through skin abrasions or cuts. At highest risk are farm workers, veterinarians, and those handling pork products.
46. T F Cats are the definitive hosts for Toxoplasmosis. Litter boxes should be changed daily as freshly deposited oocysts are not infective for 48 hours. Infections in pregnant women can lead to birth defects, chorioretinitis, blindness, and severe neurologic sequelae, with mental retardation in infants.
47. T F Tuberculosis is carried by humans and the environment and can be transmitted to primates. Reportable to the USDA's Veterinary Services National Animal Health Program.
48. T F Tularemia is carried by wild rodents and rabbits. Tularemia is an occupational risk for lab animal workers.
49. T F Viral Hepatitis is found in humans and rarely in nonhuman primates. Transmission is high in biomedical settings due to required quarantining and testing of nonhuman primates.
50. T F Viral Hepatitis can be prevented through handwashing; thorough cleaning of utensils and bedding. Two effective inactivated hepatitis A vaccines are available.

DON'T LEAVE ANY QUESTIONS UNANSWERED, THEY WILL BE MARKED INCORRECT!

2007 Evaluation of "Take Home" Zoonotic Disease of Research Animals Module - V. A

Thank you for completing this "self-instruction" module. Please take time to complete the short evaluation form. Your comments are valuable in designing the style and substance of future certification courses to make this process effective for research staff. (circle one)

Was this packet useful? YES NO

Did you learn anything new? YES NO

Was the training adequate? YES NO

Was the packet too long? YES NO If so, suggested items to cut:

Were the questions too difficult or was it hard to find answers to the questions? YES NO

Did you like the self-instruction packet? YES NO, I would you prefer to attend a lecture.

Do you have any other comments or suggestions to improve this module? Topics not covered?