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# Risk of Importing Zoonotic Diseases through Wildlife Trade, United States

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The United States is the world's largest wildlife importer, and imported wild animals represent a potential source of zoonotic pathogens. Using data on mammals imported during 2000–2005, we assessed their potential to host 27 selected risk zoonoses and created a risk assessment that could inform policy making for wildlife importation and zoonotic disease surveillance. A total of 246,772 mammals in 190 genera (68 families) were imported. The most widespread agents of risk zoonoses were rabies virus (in 78 genera of mammals), *Bacillus anthracis* (57), *Mycobacterium tuberculosis* complex (48), *Echinococcus* spp. (41), and *Leptospira* spp. (35). Genera capable of harboring the greatest number of risk zoonoses were *Canis* and *Felis* (14 each), *Rattus* (13), *Equus* (11), and *Macaca* and *Lepus* (10 each). These findings demonstrate the myriad opportunities for zoonotic pathogens to be imported and suggest that, to ensure public safety, immediate proactive changes are needed at multiple levels.

Most emerging infectious diseases are caused by zoonotic pathogens (1,2). The number and proportion of these diseases that originate in wild animals in particular has increased substantially in the past few decades, even after accounting for increased reports of new emerging infectious diseases (1). This trend and recent pandemics of wildlife-origin infectious diseases (e.g., HIV, severe acute respiratory syndrome) suggest that targeted surveillance efforts should focus on activities that bring humans and wildlife in close contact (1,3).

The United States is among the world's largest importers of live wild animals (4) and imported >1 billion indi-

vidual animals during 2000–2004 (5). Little disease surveillance is conducted for imported animals; quarantine is required for only wild birds, primates, and some ungulates arriving in the United States, and mandatory testing exists for only a few diseases (psittacosis, foot and mouth disease, Newcastle disease, avian influenza). Other animals are typically only screened for physical signs of disease, and pathogen testing is delegated to either the US Department of Agriculture (for livestock) or the importer (6). The process of preimport housing and importation often involves keeping animals at high density and in unnatural groupings of species, providing opportunities for cross-species transmission and amplification of known and unknown pathogens. Thus, imported wildlife remain a major public health threat, as exemplified by the importation of Ebola virus in primates from the Philippines (7), monkeypox from imported African rodents (8), and possibly HIV from chimpanzees in central Africa (9). Wildlife importation also poses a great threat to domestic wildlife and the US agriculture industry (5).

To analyze the volume and diversity of live mammals that have been imported into the United States in recent years, we used data from the US Fish and Wildlife Service Law Enforcement Management Information System. We focused on mammals because of the frequency and severity of previously reported mammal-borne zoonoses and because of the frequent close association between humans and many mammalian species (e.g., as pets). We then assessed the zoonotic diseases that imported mammals are known to host. Our results may be used to inform policy decisions about wildlife importation and zoonotic disease surveillance and may alert clinicians to the broad range of possible zoonoses that may be encountered in patients who have been exposed to imported animals.

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## Methods

We used Freedom of Information Act requests to obtain records from the database of the US Fish and Wildlife Service Law Enforcement Management Information System. We obtained records for all wildlife shipments into the United States during 2000–2005 through 14 of the 18 designated animal importation ports (Anchorage, Alaska; Atlanta, Georgia; Baltimore, Maryland; Boston, Massachusetts; Chicago, Illinois; Dallas, Texas; Honolulu, Hawaii; Los Angeles, California; Miami, Florida; New Orleans, Louisiana; New York, New York; Portland, Oregon; San Francisco, California; and Seattle, Washington). Data were not available for Houston, Texas; Louisville, Kentucky; Memphis, Tennessee; and Newark, New Jersey. For each importation, we acquired information on the taxonomy, quantity, source (e.g., wild-caught, farmed), country of origin, intermediate port of call, port of entry, and declared purpose of all live specimens. Descriptive analyses were performed to determine the volume of trade from various regions of the world and the types of mammals imported. Individual importation events were then grouped into genera to determine the diversity of taxa imported. The phylogenetic relationships and geographic ranges of host mammals were determined by using the Animal Diversity Web at the University of Michigan Museum of Zoology (<http://animaldiversity.ummz.umich.edu/site/index.html>).

We searched the literature to identify the zoonotic pathogens known to occur in animals of each taxon in the database. Only data on live animal importations (as opposed to animal products) and importations for which the genus was known were retained for analysis. Statistical analyses were performed by using Intercooled Stata 9 (StataCorp, College Station, TX, USA). In our final risk assessment, we did not account for the origin of each specific importation because of limitations in the database, likely caused by a complicated system of exportation and reimportation.

We created a list of relevant zoonotic diseases at risk for importation (hereafter referred to as risk zoonoses) by searching the Centers for Disease Control and Prevention website ([www.cdc.gov](http://www.cdc.gov)) and the World Health Organization website ([www.who.int](http://www.who.int)), reviewing the list of Select Agents (agents with bioterrorism potential) of the US Department of Health and Human Services (10), and consulting experts in the field. To be on the list, diseases had to meet the following 5 criteria: 1) the pathogen must be zoonotic (there must be a recorded instance of infection of a human from an animal source); 2) the pathogen must be capable of causing significant illness or death (e.g., fungal skin infections would not be on the list because although they are extremely common zoonoses, their effects are rarely debilitating); 3) the pathogen must be present in animals in the wild (i.e., not only in experimental models); 4) the pathogen must not currently be widespread in

the United States, or it must have the potential for new epidemiology with regard to transmission (e.g., *Yersinia pestis* is presently found in wild rodents in the western United States, but it is not expected to be found in animals sold as pets); and 5) if the pathogen uses an intermediate vector, competent vectors must exist in the United States. The resulting list comprised 30 risk zoonoses (20 viral diseases, 9 bacterial diseases, and 1 helminthic disease); no fungal, protozoal, or prion diseases were on the list, and thus they were not analyzed.

Determination of the host range of the risk zoonoses was accomplished through systematic genus-driven and pathogen-driven searches of PubMed databases ([www.pubmed.gov](http://www.pubmed.gov)), the Google search engine ([www.google.com](http://www.google.com)), and references within published works. Confirmed presence was defined as either isolation of the pathogen from an animal or serologic evidence of past infection. For all animals identified in the literature as carrying a risk zoonosis, genus and family were recorded. The host ranges of all of the risk zoonoses were then cross-referenced against the imported genera to generate tables showing diseases found in each imported genus (affected genera). If the disease was found in a different genus within the same family, this was also noted (potentially affected genera). The justification for this expanded risk assessment is the host nonspecificity of many infectious diseases; lack of evidence for the presence of a given disease in a given host should not be construed as evidence against its presence.

## Results

During 2000–2005, a total of 4,067 shipment fractions of mammals were imported (a shipment fraction is the sum of all animals of a single species in a given shipment; a single shipment may contain several shipment fractions), totaling 246,772 individual mammals and representing 190 genera and 68 families. The average number of animals per shipment fraction was 61 (range 1–8,000). The most common declared purpose for importation was commercial use (not classified according to pet trade, food, traditional medicine, etc.), accounting for 66% (163,760 individuals) of the total. The second most common declared purpose was biomedical research, accounting for 28% (69,986 individuals) of the total. Only a small number of individuals were imported for breeding, educational, zoo, personal, and other uses. Numbers of the most commonly imported animals were 126,014 (>50% of all imported individuals) long-tailed macaques (*Macaca fascicularis*), 30,058 small desert hamsters (*Phodopus sungorus*), 19,724 rhesus macaques (*Macaca mulatta*), 19,537 raccoons (*Procyon lotor*), and 7,112 chinchillas (*Chinchilla lanigera*). Together, these 5 species accounted for 82% of all imported individuals. By number of shipment fractions, the most common animals were 1,343 *M. fascicularis* macaques, 332 *Cal-*

*lithrix jacchus* marmosets, 229 *M. mulatta* macaques, 165 *C. lanigera* chinchillas, and 107 *Potos flavus* kinkajous.

The most common countries of origin for animal shipment fractions were People's Republic of China (717 shipment fractions); Guyana (635), United Kingdom (359), Vietnam (314), and Indonesia (305). These values must be interpreted cautiously, however, because many animals are imported and then reexported; thus, their true origin may become obscured. For example, a "wild-caught" chinchilla with a "country of origin" of Czech Republic must have originated elsewhere because chinchillas are native to Chile. A comparison between the natural geographic range of all wild-caught animals and their stated countries of origin showed that >25% of the pairings were impossible (i.e., the animals could not have come from their stated country of origin). This limitation is inherent in the way US Fish and Wildlife Service Law Enforcement Management Information System data are collected, and we were unable to correct these data.

The source of the animals was largely uninterpretable because 49% of all individuals were declared as being sourced from "animal derivatives and parts," despite the fact that we had selected only live animals for our analysis, and despite the fact that "animal derivatives and parts" is not one of the permitted responses to this question. Another 29% were declared as "captive-bred" and 15% as "wild-caught."

For the final list of risk zoonoses, 3 of the original 30 agents (Hendra virus, Menangle virus, and *Rickettsia prowazekii*) were removed because few, if any, genera were found to harbor these infections; the final tables therefore include 27 diseases (Tables 1–3). The risk zoonoses capable of infecting the greatest number of genera were: rabies viruses, in 78 genera; *Bacillus anthracis*, the causative agent of anthrax, in 57 genera; *Mycobacterium tuberculosis* complex, in 48 genera; *Echinococcus* spp., the agents of hydatid cyst disease, in 41 genera; *Leptospira* spp., in 35 genera; *Brucella* spp., the agents of undulant fever, in 32 genera; *Francisella tularensis*, the agent of tularemia, in 31 genera; Crimean-Congo hemorrhagic fever virus, in 27 genera; *Y. pestis*, the agent of plague, in 24 genera; and *Coxiella burnetii*, the agent of Q fever, in 20 genera (Table 2; online Technical Appendix, available from [www.cdc.gov/EID/content/15/11/1721-Techapp.pdf](http://www.cdc.gov/EID/content/15/11/1721-Techapp.pdf)).

If each genus within affected families is counted as potentially capable of harboring a risk zoonosis (according to the principle that many diseases are not entirely host specific), the number of genera potentially capable of harboring rabies viruses rises to 155 (82% of all imported taxa); potential carriers of *Leptospira* spp. increase to 131; *M. tuberculosis* complex to 124; *F. tularensis* to 115; *B. anthracis* to 113; *C. burnetii* to 108; and *Y. pestis* to 101.

The genera capable of harboring the greatest number of risk zoonoses were *Canis* (dogs) and *Felis* (cats), 14

Table 1. Risk zoonoses and their associated clinical syndromes in humans\*

Pathogen	Primary clinical syndrome in humans
<b>Viruses</b>	
Lymphocytic choriomeningitis virus	Aseptic meningitis
Cercopithecine herpesvirus-1 (herpes B)	Encephalitis
Nipah virus	Encephalitis
Rabies viruses†	Encephalitis
Venezuelan equine encephalitis virus	Encephalitis
Tick-borne encephalitis virus complex‡	Encephalitis or hemorrhagic fever
Crimean-Congo hemorrhagic fever virus	Hemorrhagic fever
Ebola viruses‡	Hemorrhagic fever
Lassa fever virus	Hemorrhagic fever
Marburg virus	Hemorrhagic fever
Rift Valley fever virus	Hemorrhagic fever
South American hemorrhagic fever arenaviruses‡	Hemorrhagic fever
Hantaviruses associated with HFRS†	Hemorrhagic fever with nephropathy
Hantaviruses associated with HCPS†	Severe respiratory syndrome
Highly pathogenic avian influenza (H5N1) virus	Severe respiratory syndrome
SARS virus (or SARS-like CoV)	Severe respiratory syndrome
Yellow fever virus	Systemic illness or hemorrhagic fever
Monkeypox virus	Systemic illness or rash
<b>Bacteria</b>	
<i>Brucella</i> spp.	Systemic illness
<i>Coxiella burnetii</i>	Systemic illness
<i>Leptospira</i> spp.	Systemic illness
<i>Bacillus anthracis</i>	Varies by site of infection
<i>Burkholderia mallei</i>	Varies by site of infection
<i>Francisella tularensis</i>	Varies by site of infection
<i>Mycobacterium tuberculosis</i> complex‡	Varies by site of infection
<i>Yersinia pestis</i>	Varies by site of infection
<b>Helminths, <i>Echinococcus</i> spp.</b>	<b>Hydatid cyst disease</b>

\*Risk zoonoses, relevant zoonotic diseases at risk for importation into the United States; HFRS, hemorrhagic fever with renal syndrome; HCPS, hantavirus cardiopulmonary syndrome; SARS, severe acute respiratory syndrome; CoV, coronavirus.

†Rabies viruses includes the zoonotic lyssaviruses Australian bat lyssavirus, Duvenhage, European bat lyssavirus 1 and 2, Mokolo, and rabies (11); tick-borne encephalitis complex includes Kyasanur Forest disease, Omsk hemorrhagic fever, and tickborne encephalitis (11); Ebolaviruses include Bundibugyo, Côte d'Ivoire, Reston, Sudan, and Zaire (11); epidemiologically relevant South American hemorrhagic fever arenaviruses include Guanarito, Junin, Machupo, and Sabia (11); hantaviruses associated with HFRS include Dobrava, Hantaan, Puumala, Saaremaa, and Seoul (11); hantaviruses associated with HCPS include Andes, Bayou, Black Creek Canal, Laguna Negra, New York, and Sin Nombre (11); *Mycobacterium tuberculosis* complex species are *M. africanum*, *M. bovis*, *M. bovis BCG*, *M. caprae*, *M. microti*, *M. pinnipedii*, and *M. tuberculosis hominis* (12).

Table 2. Risk zoonoses capable of infecting the greatest number of imported mammal genera

Pathogen	No. (%) affected genera*	No. (%) potentially affected genera†
Rabies viruses‡	78 (41)	155 (82)
<i>Bacillus anthracis</i>	57 (30)	113 (59)
<i>Mycobacterium tuberculosis</i> complex‡	48 (25)	124 (65)
<i>Echinococcus</i> spp.	41 (22)	89 (47)
<i>Leptospira</i> spp.	35 (18)	131 (69)
<i>Brucella</i> spp.	32 (17)	95 (50)
<i>Francisella tularensis</i>	31 (16)	115 (61)
Crimean-Congo hemorrhagic fever virus	27 (14)	91 (48)
<i>Yersinia pestis</i>	24 (13)	101 (53)
<i>Coxiella burnetii</i>	20 (11)	108 (57)

\*Risk zoonosis (relevant zoonotic disease at risk for importation into the United States) identified in genus; n = 190.

†Risk zoonosis identified in different genus within same family; n = 190.

‡Risk zoonoses, relevant zoonotic diseases at risk for importation into the United States. Refer to Table 1 footnote for explanation of pathogen complexes.

risk zoonoses each; *Rattus* (rats), 13; *Equus* (horses), 11; *Macaca* (macaques), 10; *Lepus* (rabbits and hares), 10; and *Ovis* (sheep) and *Vulpes* (foxes), 9 each (Table 3). Of the individuals in these high-risk genera, 49% were intended for commercial purposes and 44% were intended for biomedical research.

The families found to harbor the most risk zoonoses (excluding Hominidae because, by definition, they are capable of harboring all zoonotic diseases) were Muridae (Old World mice and rats, gerbils, whistling rats, and relatives), 21 risk zoonoses; Cricetidae (New World rats and mice, voles, hamsters, and relatives), 20; Canidae (coyotes, dogs, foxes, jackals, and wolves), 16; and Bovidae (antelopes, cattle, gazelles, goats, sheep, and relatives) and Felidae (cats), 15 each.

## Discussion

Our data demonstrate that myriad opportunities exist for key zoonotic pathogens to be imported into the United States or, if already present, to be introduced in a new context (e.g., in an animal sold as a pet). Imported animals of a large number of taxa were found to be capable of carrying risk zoonoses; these diseases include such serious public health threats as rabies, the filovirus hemorrhagic fevers, tuberculosis, and highly pathogenic avian influenza.

This study likely underestimates the broad nature of risk associated with the importation of wild animals. We examined only families in the class Mammalia that have been shown to harbor risk zoonoses; however, many pathogens routinely cross boundaries at least as high as the class level (e.g., human psittacosis from birds), if not higher. Furthermore, we included only live animals in this analysis; recent outbreaks associated with animal products (e.g., cutaneous anthrax from an imported goat hide used for

making drums) attest to the risks associated even with dead animals (13). Finally, the study can neither estimate the risk for unknown pathogens, which may be imported but not yet identified, nor assess the volume and zoonotic risk created by illegal wildlife trade. Animals may be smuggled specifically because they have been banned from trade as a result of perceived or recognized health threats. Some animals on our list of risk zoonoses have already been banned from importation (e.g., masked palm civets, birds from countries affected by highly pathogenic avian influenza [H5N1]) (14). However, pathogens have been identified in illegally imported wildlife; e.g., a pair of crested hawk-eagles (*Spizaetus nipalensis*) smuggled from Thailand and recently confiscated in Belgium were infected with highly pathogenic avian influenza (H5N1) (15).

We did not quantitatively assess the risk for transmission of each pathogen at each importation event. Rather, we attempted to demonstrate the breadth of risk associated with importations of wild animals in general. Quantitative prevalence of the various pathogens in each wildlife host is highly variable, and determining it is beyond the scope of our analysis. Some genera represent the primary reservoirs of certain pathogens (e.g., *Peromyscus* for certain hantaviruses), whereas proof of the permissiveness of other genera to certain pathogens is limited to isolated case reports (e.g., Ebola Zaire virus in the duiker *Cephalophus*). Perhaps the greatest unknown associated with quantifying risks for each of the zoonoses is a pathogen's infectivity in various hosts. Some pathogens may increase to a high enough load in their hosts to be infectious; others may cause nothing more than a measurable serologic response in what is otherwise a dead-end host (though explicitly known dead-end hosts have been excluded from these analyses).

Our analysis highlights several ways that the US Fish and Wildlife Service could improve data collection. To enhance public health officials' ability to trace back the sources of imported zoonotic diseases, record keeping of the point of origin of shipments could be expanded to include not just their most recent and previous point of origin (as is currently done with the "Country of Origin" and "Country of Importation/Exportation/Re-importation") but

Table 3. Mammal genera capable of harboring the greatest number of risk zoonoses\*

Genus (common name)	No. (%) risk zoonoses
<i>Canis</i> (dogs)	14 (52)
<i>Felis</i> (cats)	14 (52)
<i>Rattus</i> (rats)	13 (48)
<i>Equus</i> (horses)	11 (41)
<i>Macaca</i> (macaques)	10 (37)
<i>Lepus</i> (rabbits and hares)	10 (37)
<i>Ovis</i> (sheep)	9 (33)
<i>Vulpes</i> (foxes)	9 (33)

\*Risk zoonoses, relevant zoonotic diseases at risk for importation into the United States; n = 27.

also their actual origin. Accurate recording of the source of the animals (e.g., wild-caught, captive-bred) is also needed. Our results showed that half of all individuals had a declared source that was not one of the allowed choices (e.g., wild-caught, captive-bred). The source of an animal affects not only the likely level of risk (i.e., one would expect captive-bred individuals to carry fewer zoonotic diseases than wild-caught individuals) but also mitigation strategies when zoonotic diseases are identified (e.g., euthanizing a colony vs. improving quarantine after capture).

The potential for importation of zoonoses that would pose a major public health threat suggests that increased surveillance should be applied to imported wildlife in the United States. One opportunity to reduce this threat is restriction of importation of key high-risk species, as was done when the Centers for Disease Control and Prevention used emergency powers to restrict importation of Gambian pouched rats during the monkeypox outbreak (14). Given the great diversity of animals identified by our analysis as potentially hazardous, broad importation bans would likely be necessary if the goal were to substantially decrease the overall risk. Political or social support may be limited for such broad bans, both in the United States (as one of the world's largest purchasers of wildlife) and abroad (where wildlife trade can have profound economic benefits).

Furthermore, illegalizing trade may only increase underground (illicit) trade, thereby eliminating the possibility of screening shipments for potential hazards. A more effective and acceptable strategy would be enhancing surveillance for the specific pathogens noted for the key risk genera (those harboring the greatest number of risk zoonoses, i.e., *Canis*, *Felis*, *Rattus*, *Equus*, *Macaca*, *Lepus*, *Ovis*, and *Vulpes*). Notably, the numbers of shipments of mammals is low relative to other wildlife groups (e.g., fish and reptiles). Lawmakers' interests in protecting our borders from external bioterrorism threats intersect with the need to protect ourselves from zoonotic diseases; many Category A bioterrorism threats (e.g., anthrax, plague, tularemia, and the viral hemorrhagic fevers) (10) are represented in the risk zoonoses outlined above. Finally, to facilitate the standardization of surveillance and detection of infection events, the Council of State and Territorial Epidemiologists should include all of the risk zoonoses among their states' notifiable diseases (most of which are already included).

Perhaps one of the simplest practical interventions for minimizing zoonotic disease risk is reduction of opportunities for transmission from wildlife to humans. Although a large proportion of imported animals are destined for biomedical research (in which potential occupational risks are largely understood and quarantine procedures likely mitigate risk), a greater proportion (even among the high-risk genera) are destined for commercial use and therefore could

expose a wider group of persons to zoonotic diseases. Education of professionals likely to come in close contact with imported animals (e.g., veterinarians, importers, pet store employees), as well as the general public, should emphasize the risks for contracting zoonotic diseases from wildlife and pets (16) and the need for proper hygiene, safety procedures, and personal protective equipment (17).

The recommendations above mirror others that exist in policy documents by the Defenders of Wildlife (5), in the 2003 joint position statement by the National Association of Public Health Veterinarians and the Council of State and Territorial Epidemiologists (18), and in a recent Policy Forum article (19). These reports describe clear steps for mitigating the risks presented by imported wildlife, yet their recommendations have so far gone largely unheeded. To ensure public safety, immediate proactive changes are needed at multiple levels. Such measures would be most effective if organized in consultation with groups involved in the wildlife trade.

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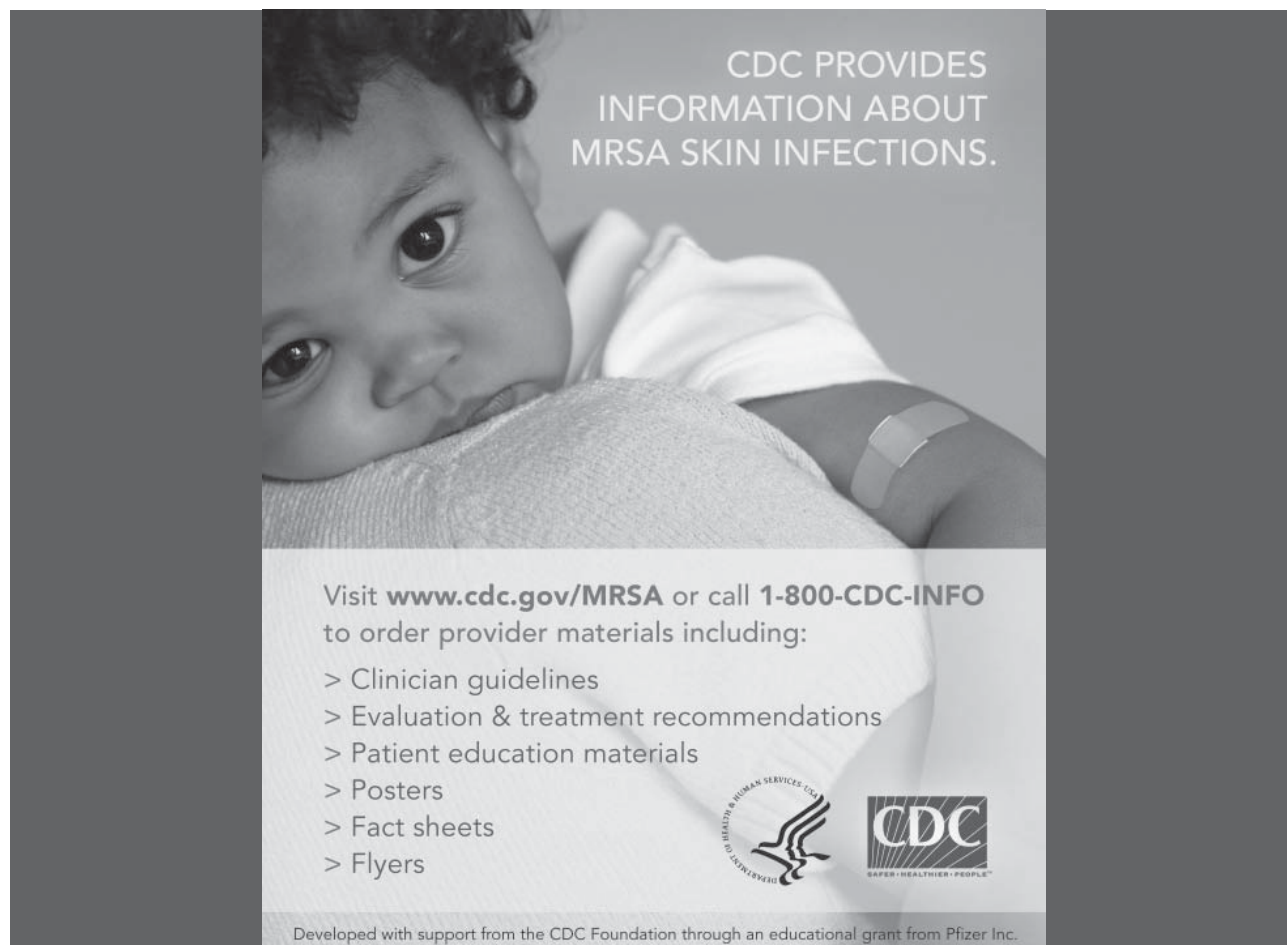
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#### References

1. Jones KE, Patel NG, Levy MA, Storeygard A, Balk D, Gittleman JL, et al. Global trends in emerging infectious diseases. *Nature*. 2008;451:990–3. DOI: 10.1038/nature06536
2. Taylor LH, Latham SM, Woolhouse ME. Risk factors for human disease emergence. *Philos Trans R Soc Lond B Biol Sci*. 2001;356:983–9. DOI: 10.1098/rstb.2001.0975
3. Wolfe ND, Dunavan CP, Diamond J. Origins of major human infectious diseases. *Nature*. 2007;447:279–83. DOI: 10.1038/nature05775
4. US Fish and Wildlife Service. U.S. wildlife trade: an overview for 1997–2003 [cited 2007 Apr 7]. Available from <http://www.fws.gov/le/pdffiles/Wildlife%20Trade%20Overview%20Report.pdf>
5. Defenders of Wildlife. Broken screens: the regulation of live animal imports in the United States. Washington: The Defenders; 2007 [cited 2008 Feb 20]. Available from <http://www.fws.gov/le/pdffiles/Wildlife%20Trade%20Overview%20Report.pdf>

6. Associated Press. Imported animals pose major health threat. Nov 28, 2006 [cited 2007 Apr 7]. Available from <http://www.cbsnews.com/stories/2006/11/28/health/main2211698.shtml>
7. Jahrling PB, Geisbert TW, Dalgard DW, Johnson ED, Ksiazek TG, Hall WC, et al. Preliminary report: isolation of Ebola virus from monkeys imported to USA. *Lancet*. 1990;335:502–5. DOI: 10.1016/0140-6736(90)90737-P
8. Guarner J, Johnson BJ, Paddock CD, Shieh W-J, Goldsmith CS, Reynolds MG, et al. Monkeypox transmission and pathogenesis in prairie dogs. *Emerg Infect Dis*. 2004;10:426–31.
9. Keele BF, Van Heuverswyn F, Li Y, Bailes E, Takehisa J, Santiago ML, et al. Chimpanzee reservoirs of pandemic and nonpandemic HIV-1. *Science*. 2006;313:523–6. DOI: 10.1126/science.1126531
10. Department of Health and Human Services. HHS and USDA select agents and toxins: 7 CFR Part 331, 9 CFR Part 121, and 42 CFR Part 73 [cited 2007 Apr 10]. Available from <http://www.selectagents.gov/Select%20Agents%20and%20Toxins%20List.html>
11. International Committee on Taxonomy of Viruses. The universal database of the International Committee on Taxonomy of Viruses [cited 2009 Sep 19]. Available from <http://www.ncbi.nlm.nih.gov/ICTVdb/>
12. Cousins DV, Bastida R, Cataldi A, Quse V, Redrobe S, Dow S, et al. Tuberculosis in seals caused by a novel member of the *Mycobacterium tuberculosis* complex: *Mycobacterium pinnipedii* sp. nov. *Int J Syst Evol Micr* 2003;53:1305–14.
13. Centers for Disease Control and Prevention. Cutaneous anthrax associated with drum making using goat hides from West Africa—Connecticut, 2007. *MMWR Morb Mortal Wkly Rep*. 2008;57:628–31.
14. Centers for Disease Control and Prevention. Restricted animals, agents, hosts, and vectors [cited 2009 Sep 22]. Available from <http://www.cdc.gov/ncidod/dq/animal/restricted.htm>
15. Van Borm S, Thomas I, Hanquet G, Lambrecht B, Boschmans M, Dupont G, et al. Highly pathogenic H5N1 influenza virus in smuggled eagles, Belgium. *Emerg Infect Dis*. 2005;11:702–5.
16. Centers for Disease Control and Prevention. Healthy pets, healthy people [cited 2007 Apr 26]. Available from <http://www.cdc.gov/healthypets>
17. Elchos BL, Scheffel JM, Cherry B, DeBess EE, Hopkins SG, Levine JF, et al. Compendium of veterinary standard precautions for zoonotic disease prevention in veterinary personnel. *J Am Vet Med Assoc*. 2008;233:415–32. DOI: 10.2460/javma.233.3.415
18. Council of State and Territorial Epidemiologists and National Association of State Public Health Veterinarians. Developing importation and exportation restrictions on exotic and native wildlife with potential adverse impact on public health. Policy statement #03-ID-13, 2003 [cited 2008 Oct 20]. Available from <http://www.cste.org/PS/2003pdfs/03-ID-13%20-%20FINAL.pdf>
19. Smith KF, Behrens M, Schloegel LM, Marano N, Burgiel S, Daszak P. Reducing the risks of the wildlife trade. *Science*. 2009;324:594–5.

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# Risk of Importing Zoonotic Diseases through Wildlife Trade, United States

## Technical Appendix

Technical Appendix Table. Risk zoonoses capable of infecting mammals imported into the United States, 2000–2005

		Total potential Risk Zoonoses (i.e., Risk Zoonosis found within family)		
		Total Risk Zoonoses in genus		
Genus	Common name or type	Family	Viruses	
			Helminths	Bacteria
			Lymphocytic choriomeningitis virus 2,29,30,80,222,226 Cercopithecine herpesvirus-1 (herpes B) 2,75,80,192,193 Nipah virus 2,77,80,230 Rabies viruses* 2,32-74,80,135,195,227-229,233 Venezuelan equine encephalitis virus 1,2,21,23,80 Tick-borne encephalitis virus complex* 2,18,19,76,80,186,191,198 Crimean-Congo hemorrhagic fever virus 2-26,80 Ebola viruses* 1,2,24-28,80,189,223 Lassa fever virus 2,49,80 Marburg virus 2,28,29,80,212,225 Rift Valley fever virus 1,2,7-15,80,190 South American hemorrhagic fever arenaviruses* 2,3,16,17,80 Hantaviruses associated with HFRS* 2,78-80,190,191,216,231 Hantaviruses associated with HCPS* 2,78-80,231 Highly pathogenic avian influenza (H5N1) virus 2,4,9,80,83,215 SARS virus (or SARS-like CoV) 2,31,80,194,225,226 Yellow fever virus 2,20,80,202 Monkeypox virus 2,80-82,198,199,206 Brucella spp. 2,49,80,94-100,208,211,221 Coxiella burnetii 2,80,106-115,187,204,205,207,220 Leptospira spp. 2,80,136-148,187,202,205,209,210,218,219,232 Bacillus anthracis 2,49,80,84-93 Burkholderia mallei 2,80,149 Francisella tularensis 2,80,150-162,188,201 Mycobacterium tuberculosis complex* 2,49,80,116-135,196,200,202,217 Yersinia pestis 2,32,80,101-105 Echinococcus spp. 2,80,163-184,186,196,203	
<i>Acinonyx</i>	Cheetah	Felidae	o	o
<i>Aepyceros</i>	Impala	Bovidae	X	o
<i>Ailuropoda</i>	Giant panda	Ursidae	o	o
<i>Alcelaphus</i>	Hartebeest	Bovidae	o	o
<i>Alopex</i>	Fox	Canidae	X	o
<i>Amblonyx</i>	Otter	Mustelidae	o	o
			3	15
			7	15
			1	7
			3	15
			4	16
			-	11

<i>Antidorcas</i>	Springbok	Bovidae	o	o	X	o	o	X	o	o	o								o			o	X	o	o	X						4	15	
<i>Aonyx</i>	Clawless otter	Mustelidae			o	o	o		o	o	o	o		o	o	o										o						-	11	
<i>Aotus</i>	Monkey	Aotidae			X	o		o	o	o		o	o		o					o		o				o		o				1	12	
<i>Atelerix</i>	Hedgehog	Erinaceidae			o	X			o			X												X			X					4	6	
<i>Bison</i>	Bison	Bovidae	X	o	X	o	o	X	o	o	X								o			o	o	o	o	X						5	15	
<i>Cacajao</i>	Uakari	Cebidae			o	o							o	o											o				o			-	6	
<i>Callithrix</i>	Monkey	Cebidae			X	X							o	X												X			X			5	6	
<i>Callosciurus</i>	Squirrel	Sciuridae	o	o		o			o	o	o								o				o	o	o							-	10	
<i>Canis</i>	Canine	Canidae	X	X	X	X	X	o	X	X	X			o	X				X					X		X	X	X					14	16
<i>Capromys</i>	Rodent	Capromyidae																														-	-	
<i>Caracal</i>	Caracal	Felidae	o	o	o	o	o	X	o	o	o			o	o				o					o		X	o					2	15	
<i>Castor</i>	Beaver	Castoridae	X			X																				X						3	3	
<i>Cavia</i>	Guinea pig	Caviidae		X				X																		X						3	3	
<i>Cebus</i>	Monkey	Cebidae			X	o							o	X												o		X	o			3	7	
<i>Cephalophus</i>	Duiker antelope	Bovidae	o	o	o	o	o	o	o	o	o								o				X	o	o	o	o					1	15	
<i>Cephalorhynchus</i>	Dolphin	Delphinidae			o	o	o			o		X	o	o												o	o						1	9
<i>Ceratotherium</i>	White rhinoceros	Rhinocerotidae			X			X	o									X					X										4	5
<i>Cercopithecus</i>	Guenon	Cercopithecidae			X	X		X	X	o		X	X		o				X		o				o		o						7	12
<i>Cerdocyon</i>	Fox	Canidae	X	o	o	o	o	o	o	o	o			o	o				o				o		o		o	X	o				2	16
<i>Cervus</i>	Deer	Cervidae	X	o	X	o		X	X	X	X																X						7	9
<i>Chaeropus</i>	Bandicoot	Peramelidae																															-	-
<i>Chaetophractus</i>	Armadillo	Dasypodidae																								o							-	1
<i>Cheirogaleus</i>	Dwarf lemur	Cheirogaleidae																															-	-
<i>Chinchilla</i>	Chinchilla	Chinchillidae											X														X					2	2	



<i>Chlorocebus</i>	Monkey	<i>Cercopithecidae</i>			o	o		o	o	o		o	o					X	o			o	X	2	12	
<i>Choloepus</i>	Sloth	<i>Megalonychidae</i>										X												1	1	
<i>Civettictis</i>	African civet	<i>Viverridae</i>			o			X	o				o	o						o		X		2	7	
<i>Coendou</i>	Porcupine	<i>Erethizontidae</i>										X												1	1	
<i>Colobus</i>	Monkey	<i>Cercopithecidae</i>			o	o		X	o	o		o	X	o				o	o			X	X	4	12	
<i>Connochaetes</i>	Wildebeest	<i>Bovidae</i>	X	o	X	o	o	X	o	o	X							X		o	o	o	o	o	5	15
<i>Cricetomys</i>	Pouched rat	<i>Nesomyidae</i>										X												1	1	
<i>Cricetus</i>	Hamster	<i>Cricetidae</i>	o	X	o	X		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	X	o	3	20
<i>Crocuta</i>	Hyena	<i>Hyaenidae</i>	X		X			X	X		X												X		6	6
<i>Crossarchus</i>	Mongoose	<i>Herpestidae</i>			o																	X		1	2	
<i>Cryptomys</i>	Mole rat	<i>Bathyergidae</i>																						-	-	
<i>Cryptoprocta</i>	Fosa	<i>Viverridae</i>			o			X	o				o	o						o		o		1	7	
<i>Cryptotis</i>	Shrew	<i>Soricidae</i>				o								o					o	o	o	o		-	5	
<i>Cynictis</i>	Mongoose	<i>Herpestidae</i>			o																	X		1	2	
<i>Cynomys</i>	Prairie dog	<i>Sciuridae</i>	o	X		X		o	o		X						o			o	o	o		X	4	11
<i>Dactylopsila</i>	Striped possum	<i>Petauridae</i>						o																-	1	
<i>Damaliscus</i>	Antelope	<i>Bovidae</i>	X	o	X	o	o	X	o	o	X						o		o	X	o	o	X	6	15	
<i>Dasyprocta</i>	Agouti	<i>Dasyproctidae</i>	X									X												2	2	
<i>Dasypus</i>	Armadillo	<i>Dasypodidae</i>																				X		1	1	
<i>Dendrohyrax</i>	Hyrax	<i>Hyracoidea</i>		o				o														X		1	3	
<i>Dendrolagus</i>	Kangaroo	<i>Macropodidae</i>		o				o	o															-	3	
<i>Desmodus</i>	Vampire bat	<i>Phyllostomidae</i>																				X	X	2	2	
<i>Dolichotis</i>	Mara	<i>Caviidae</i>		o				o														o		-	3	
<i>Eira</i>	Tayra	<i>Mustelidae</i>		o	o	o		o	o	o	o	X	o	o								o		1	11	





<i>Marmosa</i>	Mouse opossum	<i>Didelphidae</i>		o	o	o			o		o	o	o												X	o							1	9		
<i>Mastomys</i>	Multimammate rat	<i>Muridae</i>	X	o	o	o		o	X	o	o	o	o	o	o	o	o	o	o							X	o	X	o		X		o		5	21
<i>Mellivora</i>	Badger	<i>Mustelidae</i>		o	X	o		X	o	o	o		o	o	o											X								3	11	
<i>Melursus</i>	Sloth bear	<i>Ursidae</i>		o		o		o	o	o	o															X								1	7	
<i>Mephitis</i>	Skunk	<i>Mustelidae</i>		X	o	X		X	X	X	X		o	o	o											X								7	11	
<i>Meriones</i>	Jird	<i>Muridae</i>	X	X	o	X		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	3	21
<i>Mesocricetus</i>	Hamster	<i>Muridae</i>	o	o	o	X		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	1	21
<i>Microcebus</i>	Mouse lemur	<i>Cheirogaleidae</i>																																-	-	
<i>Mirounga</i>	Elephant seal	<i>Phocidae</i>							X	o	o															o								1	4	
<i>Mus</i>	Mouse	<i>Muridae</i>	X	o	o	X		o	X	X	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	X	o	X		X		X		8	21
<i>Mustela</i>	Weasel	<i>Mustelidae</i>		X	X	X		X	X	o	o		X	X	o											X								8	11	
<i>Myotis</i>	Bat	<i>Vespertilionidae</i>						X					o				o	o							o	X	X						3	7		
<i>Myrmecophaga</i>	Giant anteater	<i>Myrmecophagidae</i>										X	o																					1	2	
<i>Nasua</i>	Coati	<i>Procyonidae</i>		o	o	o		X	o	o	o	X														X								3	9	
<i>Neophocaena</i>	Porpoise	<i>Phocoenidae</i>									o																							-	1	
<i>Neotragus</i>	Antelope	<i>Bovidae</i>	o	o	o	o	o	o	o	o	o	o						o			o	o	o	o	o									-	15	
<i>Nyctereutes</i>	Raccoon dog	<i>Canidae</i>	X	o	o	o	o	o	o	o	o			X	o			o								o		o	X	o				3	16	
<i>Nycticebus</i>	Slow loris	<i>Loridae</i>			X																													1	1	
<i>Odocoileus</i>	Deer	<i>Cervidae</i>	X	X	X	X		X	o	o	X															X								7	9	
<i>Oreotragus</i>	Antelope	<i>Bovidae</i>	o	o	o	o	o	X	o	o	o						o			o	o	o	o	o										1	15	
<i>Orycteropus</i>	Aardvark	<i>Orycteropodidae</i>						X																		X								2	2	
<i>Oryctolagus</i>	European rabbit	<i>Leporidae</i>	o	o		X		X	o	o	X														o	o	X						4	10		
<i>Oryx</i>	Oryx	<i>Bovidae</i>	o	o	X	o	o	X	o	o	X						o			o	X	o	o	o										4	15	
<i>Otocolobus</i>	Pallas cat	<i>Felidae</i>	o	o	o	o	o	o	o	o	o			o	o											X		o	o					1	15	



<i>Procyon</i>	Raccoon	<i>Procyonidae</i>	X	X	X		X	X	X	X	o										X				8	9		
<i>Psammomys</i>	Rodent	<i>Muridae</i>	o	o	o	o		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	-	21		
<i>Pseudalopex</i>	Fox	<i>Canidae</i>	X	o	o	o	o	o	o	o	o		o	o				o			o	X	o		2	16		
<i>Pseudocheirus</i>	Ringtailed possum	<i>Pseudocheiridae</i>																							-	-		
<i>Pteronotus</i>	Bat	<i>Mormoopidae</i>																				X			1	1		
<i>Pteronura</i>	Otter	<i>Mustelidae</i>		o	o	o		o	o	o	o		o	o	o							o			-	11		
<i>Pteropus</i>	Bat	<i>Pteropodidae</i>										o				o	o		o	o	X	X			2	7		
<i>Puma</i>	Feline	<i>Felidae</i>	X	o	o	o	o	X	o	o	o		o	o			o				X	o			3	15		
<i>Pygathrix</i>	Langur	<i>Cercopithecidae</i>			o	o		o	o	o		o	o				o	o			o	o			-	12		
<i>Raphicerus</i>	Antelope	<i>Bovidae</i>	o	o	o	o	o	X	o	o	X						o			o	o	o	o	X		3	15	
<i>Rattus</i>	Rat	<i>Muridae</i>	X	X	X	X		X	X	X	o	o		X	o	o	X	o	X		o	o	o	X	X	X	13	21
<i>Ratufa</i>	Squirrel	<i>Sciuridae</i>	X	o		o		o	o		o						o				o	o	o			1	10	
<i>Redunca</i>	Reedbuck	<i>Bovidae</i>	o	o	X	o	o	X	o	o	o						o			o	X	o	o	X		4	15	
<i>Rhinolophus</i>	Bat	<i>Rhinolophidae</i>											X			X	X	X	X			X	X	X		7	7	
<i>Rhipidomys</i>	Rodent	<i>Muridae</i>	o	o	o	o		o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	-	21	
<i>Rupicapra</i>	Chamois	<i>Bovidae</i>	o	o	o	o	o	o	o	X	X							o			o	o	o	o	X		3	15
<i>Saguinus</i>	Tamarin	<i>Cebidae</i>			o	X					o	X									o		X			3	6	
<i>Saimiri</i>	Squirrel monkey	<i>Cebidae</i>			X	X		X			X	X										o		o		5	7	
<i>Scapanus</i>	Mole	<i>Talpidae</i>		X	o																	o				1	3	
<i>Sciurus</i>	Squirrel	<i>Sciuridae</i>	o	X		X		X	X		o					X					o	o	X		X	7	11	
<i>Speothos</i>	Canine	<i>Canidae</i>	o	o	o	o	o	o	o	o	o		o	o			o				o	o	o	o		-	16	
<i>Spermophilus</i>	Ground squirrel	<i>Sciuridae</i>	o	X		X		o	X		o					o					o	o	X			4	10	
<i>Suricata</i>	Suricate	<i>Herpestidae</i>			X																	X				2	2	
<i>Sylvicapra</i>	Bush duiker	<i>Bovidae</i>	o	o	o	o	o	X	o	o	X					o			o	X	o	o	X			4	15	

<i>Syncerus</i>	Cape buffalo	<i>Bovidae</i>	X	o	X	o	o	X	o	o	X								X			o	X	o	o	o					6	15		
<i>Tamandua</i>	Anteater	<i>Myrmecophagidae</i>														o	X														1	2		
<i>Tamiasciurus</i>	Squirrel	<i>Sciuridae</i>	o	X		X			o	o									o				o	o		o					2	10		
<i>Taurotragus</i>	Eland	<i>Bovidae</i>	o	o	X	o	o	X	o	o	X								o			o	X	o	o	X				5	15			
<i>Tolypeutes</i>	Armadillo	<i>Dasypodidae</i>																							o						-	1		
<i>Trachypithecus</i>	Monkey	<i>Cercopithecidae</i>			o	o		o	o	o								o	o		o					o		o			-	12		
<i>Tragelaphus</i>	Antelope	<i>Bovidae</i>	X	o	X	o	o	X	X	o	X								o			o	X	o	o	X				7	15			
<i>Tragulus</i>	Mouse deer	<i>Tragulidae</i>																													-	-		
<i>Trichosurus</i>	Brush-tail possum	<i>Phalangeridae</i>			X				X	X																				3	3			
<i>Tupaia</i>	Tree shrew	<i>Tupaiaidae</i>																													-	-		
<i>Tursiops</i>	Dolphin	<i>Delphinidae</i>		o	o	o			o		X	o	o												o	o					1	9		
<i>Ursus</i>	Bear	<i>Ursidae</i>		X		X		X	X	X	X															X				7	7			
<i>Viverra</i>	Civet	<i>Viverridae</i>			o			X	o								X	o						o		o					2	7		
<i>Vulpes</i>	Fox	<i>Canidae</i>	X	X	X	o	o	o	X	X	X				X	o			o					X		o	X	o			9	16		
<i>Wallabia</i>	Wallaby	<i>Macropodidae</i>	X					o		o																					1	3		
<i>Xerus</i>	Squirrel	<i>Sciuridae</i>	o	X		o			o	o		o							o					X	o		X			3	10			
Total affected genera †			41	24	48	31	5	57	35	20	32	13	16	8	4	1	2	-	13	4	1	5	27	6	4	78	5	6	7					
Total potentially affected genera ‡			89	101	124	115	46	113	131	108	95	62	37	56	62	17	23	17	17	76	14	17	55	91	59	46	155	23	12	25				

Legend: X = Risk Zoonosis identified in genus; o = Risk Zoonosis identified in different genus within same family.

\*Rabies viruses includes the zoonotic lyssaviruses Australian bat lyssavirus, Duvenhage, European bat lyssavirus 1 and 2, Mokoko, and rabies (234); tick-borne encephalitis complex includes Kyasanur Forest disease, Omsk hemorrhagic fever, and tickborne encephalitis (234); Ebolaviruses include Bundibugyo, Côte d'Ivoire, Reston, Sudan and Zaire (234); epidemiologically relevant South American hemorrhagic fever arenaviruses include Guanarito, Junin, Machupo, and Sabia (234); hantaviruses associated with HFRS include Dobrava, Hantaan, Puumala, Saaremaa, and Seoul (234); hantaviruses associated with HCPS include Andes, Bayou, Black Creek Canal, Laguna Negra, New York, and Sin Nombre (234); *Mycobacterium tuberculosis* complex species are *M. africanum*, *M. bovis*, *M. bovis* BCG, *M. caprae*, *M. microti*, *M. pinnipedii*, and *M. tuberculosis hominis* (235).

†Risk zoonosis identified in genus.

‡Risk zoonosis identified in different genus within same family.

## References

1. United States Animal Health Association. "The Grey Book" – Foreign Animal Diseases. [Cited 2007 Apr 26]. Available from <http://www.usaha.org/pubs/fad.pdf>
2. PathInfo. Virginia Bioinformatics Institute - PathPort: The Pathogen Portal Project. [Cited 2007 Apr 26]. Available from <http://pathport.vbi.vt.edu/pathinfo/index.php>
3. Centers for Disease Control and Prevention. Biosafety in microbiological and biomedical laboratories (BMBL), 4th ed [cited 2007 Apr 5]. Available from <http://www.cdc.gov/OD/ohs/biosfty/bmbl4/bmbl4toc.htm>
4. Ergönül O. Crimean-Congo haemorrhagic fever. *Lancet Infect Dis* 2006; 6(4): 203-214.
5. Shepherd AJ, Swanepoel R, Shepherd SP, McGillivray GM, Searle LA. Antibody to Crimean-Congo hemorrhagic fever virus in wild mammals from southern Africa. *Am J Trop Med Hyg* 1987; 36(1) 133-142.
6. Whitehouse CA. Crimean-Congo hemorrhagic fever. *Antivir Res* 2004; 63(3): 145-160.
7. World Organization for Animal Health. Animal Diseases Data [cited 2007 Apr 26]. Available from [http://www.oie.int/eng/maladies/en\\_alpha.htm?e1d7](http://www.oie.int/eng/maladies/en_alpha.htm?e1d7)
8. Anderson EC, Rowe LW. The prevalence of antibody to the viruses of bovine virus diarrhoea, bovine herpes virus 1, rift valley fever, ephemeral fever and bluetongue and to *Leptospira* sp. in free-ranging wildlife in Zimbabwe. *Epidemiol Infect* 1998; 121: 441-449.
9. Boiro I, Konstaninov OK, Numerov AD. Isolation of Rift Valley fever virus from bats in the Republic of Guinea. *Bull Soc Pathol Exot Filiales* 1987; 80(1): 62-67.
10. Davies FG, Martin V. Recognizing Rift Valley fever. *FAO Animal Health Manual No. 17*. 2003 [cited 2007 Apr 8]. Available from <http://www.fao.org/DOCREP/006/Y4611E/y4611e00.htm>
11. Youssef BZ, Donia HA. The potential role of *Rattus rattus* in enzootic cycle of Rift Valley Fever in Egypt. 1-Detection of RVF antibodies in *R. rattus* blood samples by both enzyme linked immuno sorbent assay (ELISA) and immuno-diffusion technique (ID). *J Egypt Public Health Assoc* 2001; 76(5-6): 431-441.
12. Kansas State University – National Agricultural Security Center. Rift Valley fever fact sheet [cited 2007 Apr 8]. Available from <http://nabc.ksu.edu/content/factsheets/category/Rift%20Valley%20Fever>



13. House C, Alexander KA, Kat PW, O'Brien SJ, Mangiafico J. Serum antibody to Rift Valley fever virus in African carnivores. *Ann NY Acad Sci* 1996; 791(1): 345–349.
14. United Kingdom Department of Environment, Food and Rural Affairs (DEFRA). International Animal Health Division. Preliminary outbreak assessment: Rift Valley Fever in Kenya 1/11/07 [cited 2007 Apr 5]. Available from <http://www.defra.gov.uk/animalh/diseases/monitoring/pdf/rvf-kenya.pdf>
15. Public Health Agency of Canada – Office of Laboratory Security. Material safety data sheet: Infectious substances [cited 2007 Apr 8]. Available from <http://www.phac-aspc.gc.ca/msds-ftss/msds89e.html>
16. Fulhorst CF, Ksiazek TG, Peters CJ, Tesh RB. Experimental infection of the cane mouse *Zygodontomys brevicauda* (Family Muridae) with Guanarito virus (Arenaviridae), the etiologic agent of Venezuelan hemorrhagic fever. *J Infect Dis* 1999; 180: 966–969.
17. Centers for Disease Control and Prevention. Tick-borne encephalitis [cited 2007 Apr 6]. Available from <http://www.cdc.gov/ncidod/dvrd/spb/mnpages/dispages/TBE.htm>
18. Bakhvalova VN, Dobrotvorsky AK, Panov VV, Matveeva VA, Tkachev SE, Morozova OV. Natural tick-borne encephalitis virus infection among wild small mammals in the southeastern part of western Siberia, Russia. *Vector-Borne Zoonot* 2006; 6(1): 32–41.
19. Barrett ADT, Higgs S. Yellow fever: A disease that has yet to be conquered. *Annu Rev Entomol* 2007; 52: 209–229.
20. Salas RA, Garcia CZ, Liria J, Barrera R, Navarro JC, Medina G, et al. Ecological studies of enzootic Venezuelan equine encephalitis in north-central Venezuela, 1997–1998. *Am J Trop Med Hyg* 2001; 64(1, 2): 84–92.
21. Ubico SR, McLean RG. Serologic survey of neotropical bats in Guatemala for virus antibodies. *J Wildl Dis* 1995; 31(1): 1-9.
22. Calisher CH, Maness KS. Laboratory studies of Venezuelan equine encephalitis virus in equines, Texas, 1971. *J Clin Microbiol* 1975; 2(3): 198-205.
23. Rouquet P, Froment JM, Bermejo M, Kilbourn A, Karesh W, Reed P, et al. Wild animal mortality monitoring and human Ebola outbreaks, Gabon and Republic of Congo, 2001–2003. *Emerg Infect Dis* 2005; 11(2): 283-290.
24. Leroy EM, Kumulungui B, Pourrut X, Rouquet P, Hassanin A, Yaba P, et al. Fruit bats as reservoirs of Ebola virus. *Nature* 2005; 435(7068): 575-6.
25. Georges-Courbot MC, Sanchez A, Lu CY, Baize S, Leroy E, Lansout-Soukate J, et al. Isolation and phylogenetic characterization of Ebola viruses causing different outbreaks in Gabon. *Emerg Infect Dis* 1997; 3(1): 59-62.
26. Peters CJ, LeDuc JW. An introduction to Ebola: The virus and the disease. *J Infect Dis* 1999; 179(Suppl 1): ix-xvi.

27. Iowa State University - Institute for International Cooperation in Animal Biologics. Viral Hemorrhagic Fevers–Ebola and Marburg [cited 2007 Apr 6]. Available from [http://www.cfsph.iastate.edu/Factsheets/pdfs/viral\\_hemorrhagic\\_fever\\_filovirus.pdf](http://www.cfsph.iastate.edu/Factsheets/pdfs/viral_hemorrhagic_fever_filovirus.pdf)
28. Stephensen CB, Jacob JR, Montali RJ, Holmes KV, Muchmore E, Compans RW, et al. Isolation of an arenavirus from a marmoset with callitrichid hepatitis and its serologic association with disease. *J Virol* 1991; 65(8): 3995–4000.
29. Amman BR, Pavlin BI, Albariño CG, Comer JA, Erickson BR, Oliver JB, et al. Pet rodents and fatal lymphocytic choriomeningitis in transplant patients. *Emerg Infect Dis* 2007; 13(5): 719-725.
30. Li W, Shi Z, Yu M, Ren W, Smith C, Epstein JH, et al. Bats are natural reservoirs of SARS-like coronaviruses. *Science* 2005; 310(5748): 676-9.
31. Steppan SJ, Hamm SM. Xerini: African ground squirrels. The Tree of Life Web Project [cited 2007 Apr 20]. Available from <http://tolweb.org/Xerini/16817/2006.08.10>
32. Marker LL. Aspects of cheetah (*Acinonyx jubatus*) biology, ecology and conservation strategies on Namibian farmlands. Doctoral thesis, Lady Margaret Hall, University of Oxford, 2002 [cited 2007 Apr 20]. Available from [http://www.carnivoreconservation.org/files/thesis/marker\\_2002\\_phd.pdf](http://www.carnivoreconservation.org/files/thesis/marker_2002_phd.pdf)
33. Wempe JM. Rabies in a pronghorn antelope, *Antilocapra americana*. *J Wildl Dis* 1976; 12: 347-348.
34. Riley PY, Chomel BB. Hedgehog zoonoses. *Emerg Infect Dis* 2005; 11(1): 1-5.
35. Favoretto SR, de Mattos CC, Morais NB, Alves Araújo FA, de Mattos CA. Rabies in marmosets (*Callithrix jacchus*), Ceará, Brazil. *Emerg Infect Dis* 2001; 7(6): 1062-1065.
36. Ontario Ministry of Natural Resources. Manual of common parasites, diseases and anomalies of wildlife in Ontario. Ontario: 1998, Queens Printer [cited 2007 Apr 28 ]. Available from [http://www.unbc.ca/nlui/wildlife\\_diseases/booklet.htm](http://www.unbc.ca/nlui/wildlife_diseases/booklet.htm)
37. Aghomo HO, Ako-Nai AK, Oduye OO, Tomori O, Rupprecht CE. Detection of rabies virus antibodies in fruit bats (*Eidolon helvum*) from Nigeria. *J Wildl Dis* 1990; 26(2): 258-261.
38. Greenhall AM. 1961. Bats in Agriculture. Ministry of Agriculture, Trinidad and Tobago. From: “Rabies” in Wikipedia, [www.wikipedia.org](http://www.wikipedia.org)
39. Eidson M, Matthews SD, Willsey AL, Cherry B, Rudd RJ, Trimarchi CV. Rabies virus infection in a pet guinea pig and seven pet rabbits. *J Am Vet Med Assoc* 2005; 227(6): 932-935.
40. Krebs JW, Williams SM, Smith JS, Rupprecht CE, Childs JE. Rabies among infrequently reported mammalian carnivores in the United States, 1960-2000. *J Wildl Dis* 2003; 39(2): 253-261.

41. Johnson N, Black C, Smith J, Un H, McElhinney LM, Aylan O, Fooks AR. Rabies emergence among foxes in Turkey. *J Wildl Dis* 2003; 39(2): 262-270.
42. Krebs JW, Mondul AM, Rupprecht CE, Childs JE. Rabies surveillance in the United States during 2000. *J Am Vet Med Assoc* 2001; 219(12): 1687-1699.
43. Berry HH. Surveillance and control of anthrax and rabies in wild herbivores and carnivores in Namibia. *Rev Sci Tech* 1993; 12(1): 137-146.
44. Svrcek S, Ondrejka R, Mlynarcikova K, Svec J. Rabies in the common hamster (*Cricetus cricetus*) in Slovakia. *Vet Med (Praha)* 1984; 29(11): 643-652.
45. Leffingwell LM, Neill SU. Naturally acquired rabies in an armadillo (*Dasypus novemcinctus*) in Texas. *J Clin Microbiol* 1989; 27: 174-175.
46. Wilamaratne O, Kodikara DS. First reported case of elephant rabies in Sri Lanka. *Vet Rec* 1999; 144(4): 98.
47. Arizona Department of Health Services – Office of Infectious Disease Services. Vector borne and zoonotic disease newsletter – Winter 2001 [cited 2007 Apr 5]. Available from <http://www.azdhs.gov/phs/oids/vector/zoonotic1.htm>
48. World Organisation for Animal Health. Epidemiological review of wildlife diseases. *World Animal Health – 2004* [cited 2007 Apr 29]. Available from [ftp://ftp.oie.int/SAM/2004/FAUNE\\_A.pdf](ftp://ftp.oie.int/SAM/2004/FAUNE_A.pdf)
49. Botros BA, Moch RW, Kerkor M, Helmy I. Rabies in the Arab Republic of Egypt: III. Enzootic rabies in wildlife. *J Trop Med Hyg* 1977; 80(3): 59-62.
50. Sheeler-Gordon LL, Smith JS. Survey of bat populations from Mexico and Paraguay for rabies. *J Wildl Dis* 2001; 37(3): 582-593.
51. Davidson ML. Rabies in a llama. *Vet Med* 1998; 10: 934-936.
52. Mikota S. Elephant Care International fact sheet: Rabies [cited 2007 Apr 20]. Available from <http://www.elephantcare.org/rabies.htm>
53. FORTH – For Travelers’ Health. Rabies [cited 2007 Apr 20]. Available from <http://www.forth.go.jp/mhlw/animal/down/1dog/information-update.pdf>
54. Bishop GC, Durrheim DN, Kloock PE, Godlonton JD, Bingham J, Speare R. Rabies: Guide for the medical, veterinary and allied health professions. Republic of South Africa Rabies Advisory Group [cited 2007 Apr 20]. Available from <http://www.nda.agric.za/docs/rabiesB5.pdf>
55. World Health Organization Technical Report Series #931. WHO expert consultation on rabies [cited 2007 Apr 20]. Available from [http://www.who.int/rabies/trs931\\_%2006\\_05.pdf](http://www.who.int/rabies/trs931_%2006_05.pdf)
56. Schoop U. *Praomys (Mastomys) natalensis*: an African mouse capable of sustaining persistent asymptomatic rabies infection. *Ann Microbiol (Paris)* 1997; 128(2): 289-298.
57. Jadav KK. Rabies in captive sloth bears (*Melursus ursinus*). 1st Scientific Meeting of the Asian Zoo & Wildlife Medicine 2005 [cited 2007 Apr 27]. Available from <http://blog.goo.ne.jp/jszwd>

58. Nel LH, Sabeta CT, von Teichman B, Jaftha JB, Rupprecht CE, Bingham J. Mongoose rabies in southern Africa: A re-evaluation based on molecular epidemiology. *Virus Res* 2005; 109(2): 165-173.
59. Favoretto SR, Carrieri ML, Cunha EMS, Aguiar EAC, Silva LH, Sodre MM, et al. Antigenic typing of Brazilian rabies virus samples isolated from animals and humans, 1989-2000. *Rev Inst Med Trop S Paulo* 2002; 44(2): 91-95.
60. Krebs JW, Noll HR, Rupprecht CE, Childs JE. Rabies surveillance in the United States during 2001. *J Am Vet Med Assoc* 2002; 221(12): 1690-1701.
61. Potter TM, Hanna JA, Freer L. Human North American river otter (*Lontra canadensis*) attack. *Wild Environ Med* 2007; 18(1): 41-44.
62. Shulaw W, James RE. Ohio State University Extension fact sheet: Rabies prevention in livestock [cited 2007 Apr 27]. Available from <http://ohioline.osu.edu/vme-fact/0001.html>
63. Miot MR, Sikes RK, Silberman MS. Rabies in a chimpanzee. *J Am Vet Med Assoc* 1973; 162(1): 54.
64. Centers for Disease Control and Prevention. Epidemiologic notes and reports rabies in a javelina – Arizona. *MMWR* 1986; 35(35): 555-6,561.
65. Merck Veterinary Manual – Viral Diseases. Marine mammals: Viral diseases [cited 2007 Apr 27]. Available from <http://www.merckvetmanual.com/mvm/index.jsp?cfile=htm/bc/170811.htm>
66. Cunha EMS, da Silva LHQ, Lara MCCSH, Nassar AFC, Albas A, Sodre MM, et al. Bat rabies in the north-northwestern regions of the state of Sao Paulo, Brazil: 1997-2002. *Rev Saude Publica* 2006; 40(6): 1082-1086.
67. Brandao N. Phylogeny of a rabies virus variant with an unusual antigenic pattern isolated from platyrrhinus sp from northern Brazil. The XV International Conference Rabies in the Americas (RITA XV), 2004 [cited 2007 Apr 28]. Available from <http://rita15.rabies-in-the-americas.org/I/program.htm>
68. Sato G, Kobayashi Y, Shoji Y, Sato T, Itou T, Ito FH, et al. Molecular epidemiology of rabies from Maranhao and surrounding states in the northeastern region of Brazil. *Arch Virol* 2006; 151(11): 2243-2251.
69. Pal SR, Arora B, Chhuttani PN, Broor S, Choudhury S, Joshi RM, et al. Rabies virus infection of a flying fox bat, *Pteropus poliocephalus* in Chandigarh, Northern India. *Trop Geogr Med* 1980; 32(3): 265-7.
70. Arkanimals.com. Cougar incidents & mountain lion attacks expert comments. Available at: [www.arkanimals.com/dlg/cougar.htm](http://www.arkanimals.com/dlg/cougar.htm)
71. Centers for Disease Control and Prevention. Cases of rabies in the United States and Puerto Rico, by state and category, 2001 [cited 2007 Apr 28]. Available from <http://www.cdc.gov/ncidod/dvrd/rabies/Professional/publications/Surveillance/Surveillance01/Table1-01.htm>

72. Padilla M, Dowler RC. *Tapirus terrestris*. Mammalian Species, No. 481. American Society of Mammalogists 1994 [cited 2007 Apr 5]. Available from [http://links.jstor.org/sici?sici=0076-3519\(19941202\)5:481%3C1:TT%3E2.0.CO;2-G](http://links.jstor.org/sici?sici=0076-3519(19941202)5:481%3C1:TT%3E2.0.CO;2-G)
73. Mutinelli F, Lattuada E, Mustoni A. Detection of rabies antibodies in a brown bear (*Ursus arctos*). *Vet Rec* 2001; 149(25): 779-780.
74. University of Connecticut Health Center – Animal Care Committee. Cercopithecine herpesvirus 1 (Herpes B virus) [cited 2007 Apr 5]. Available from <http://clacc.uhc.edu/ACC/Occupational%20Health%20and%20Safety/HerpesB.htm>
75. Acha PN, Szyfres B. Kyasanur Forest disease. In: Zoonoses and communicable diseases common to man and animals, third edition - Volume II: Chlamydioses, rickettsioses, and viroses [cited 2007 Apr 6]. Available from <http://athena.bioc.uvic.ca/bioDoc/flaviviridae/flavivirus/kyasanur.pdf>
76. Centers for Disease Control and Prevention. Hendra virus disease and Nipah virus encephalitis [cited 2007 Apr 8]. Available from <http://www.cdc.gov/ncidod/dvrd/spb/mnpages/dispages/nipah.htm>
77. Herbreteau V, Gonzalez JP, Hugot JP. Implication of phylogenetic systematics of rodent-borne hantaviruses allows understanding of their distribution. *Ann NY Acad Sci* 2006; 1081: 39-56.
78. Kariwa H, Lokugamage K, Lokugamage N, Miyamoto H, Yoshii K, Nakauchi M, et al. A comparative epidemiological study of hantavirus infection in Japan and Far East Russia. *Jpn J Vet Res* 2007; 54(4): 145-161.
79. Focosi D. Molecular Medicine [cited 2007 Apr 10]. Available from <http://focosi.altervista.org>
80. Centers for Disease Control and Prevention. Human monkeypox – Kasai Oriental, Zaire, 1996-1997. *MMWR* 1997; 46(14): 304-307.
81. Khodakevich L, Szczeniowski M, Manbu-ma-Disu, Jezek Z, Marennikova S, Nakano J, et al. The role of squirrels in monkeypox virus transmission. *Trop Geogr Med* 1987; 39(2): 115-122.
82. Cyranoski D. Bird flu data languish in Chinese journals. *Nature* 2004; 430(7003): 955.
83. Clegg SB, Turnbull PCB, Foggini CM, Lindeque PM. Massive outbreak of anthrax in wildlife in the Malilangwe Wildlife Reserve, Zimbabwe. *Vet Rec* 2007; 160: 113-118.
84. Nishi JS, Ellsworth TR, Lee N, Dewar D, Elkin BT, Dragon DC. Northwest Territories. An outbreak of anthrax (*Bacillus anthracis*) in free-roaming bison in the Northwest Territories, June-July 2006. *Can Vet J* 2007; 48(1): 37-38.
85. Ikede BO, Falade S, Golding RR. Anthrax in captive carnivores in Ibadan, Nigeria. *J Wildl Dis* 1976; 12(2): 130-132.

86. Louisiana State University – World Health Organization Collaborating Center for Remote Sensing and Geographic Information Systems for Public Health. World Anthrax Data Site [cited 2007 Apr 4]. Available from <http://www.vetmed.lsu.edu/whocc/AnthraxStats2001-DataFiles/Asia/India.htm>
87. Shiferaw F, Abditcho S, Gopilo A, Laurenson MK. Anthrax outbreak in Mago National Park, southern Ethiopia. *Vet Rec* 2002; 150: 318-320.
88. Hugh-Jones ME, de Vos V. Anthrax and wildlife. *Rev Sci Tech Off Int Epiz* 2002; 21(2): 359-383.
89. Bookrags.com. Anthrax summary pack [cited 2007 Apr 28]. Available from <http://www.bookrags.com/Anthrax>
90. Brashares JS, Arcese P, Sam MK, Coppolillo PB, Sinclair ARE, Balmford A. Bushmeat hunting, wildlife declines, and fish supply in West Africa. *Science* 2004; 306(5699): 1180-1183.
91. Pura Petspourri. Outbreaks of anthrax [cited 2007 Apr 28]. Available from <http://www.petspourri.com/trends05.htm>
92. Dodgson SJ, Forster RE II. Carbonic anhydrase activity of intact erythrocytes from seven mammals. *J Appl Physiol* 1983; 55(4): 1292-1298.
93. U.S. Department of the Interior – Minerals Management Service. Population dynamics and biology of the California sea otter (*Enhydra lutris nereis*) at the southern end of its range. 2006 [cited 2007 Apr 28]. Available from <http://www.coastalresearchcenter.ucsb.edu/cmi/files/2006-007.pdf>
94. McDonald WL, Jamaludin R, Mackereth G, Hansen M, Humphrey S, Short P, et al. Characterization of a *Brucella* sp. strain as a marine-mammal type despite isolation from a patient with spinal osteomyelitis in New Zealand. *J Clin Microbiol* 2006; 44(12): 4363-4370.
95. Nielsen K, Duncan JR. Animal Brucellosis. 1990. CRC Press [cited 2007 Apr 30]. Available from <http://books.google.com/books?id=QQFDHBpNnTQC&pg=RA1-A143&lpg=RA1-PA143&dq=phacochoerus+brucella&sig=lmsalk7okERH4OAz9a2K16vZOuo#PPA1,M1>
96. Lundervold M. Infectious diseases of saiga antelopes and domestic livestock in Kazakhstan. Doctoral thesis, University of Warwick, UK, 2001 [cited 2007 Apr 2]. Available from <http://www.iccs.org.uk/papers/lundervold-thesis.pdf>
97. Higgins R. Bacteria and fungi of marine mammals: A review. *Can Vet J* 2000; 41: 105-116.
98. Schiemann B, Staak C. *Brucella melitensis* in impala (*Aepyceros melampus*). *Vet Rec* 1971; 88(13): 344.
99. Ito FH, Vasconcellos SA, Bernardi F, Nascimento AA, Labruna MB, Arantes IG. Serological evidence of brucellosis, leptospirosis and parasitism by ixodid ticks in wild animals of the pantanal of Mato Grosso do Sul, Brazil. *Ars-Veterinaria* 1998; 14(3): 302-310.
100. Levy CE, Gage KL. Plague in the United States, 1995-1997. *Infect Med* 1999; 16(1): 54-64.
101. Ruiz A. Plague in the Americas. *Emerg Infect Dis* 2001; 7(3 Suppl.): 539-540.

102. Salkeld DJ, Stapp P. Seroprevalence rates and transmission of plague (*Yersinia pestis*) in mammalian carnivores. *Vector-Borne Zoonot* 2006; 6(3): 231-239.
103. Nelson BC. Plague studies in California – the roles of various species of sylvatic rodents in plague ecology in California. *Proceedings of the 9th Vertebrate Pest Conference*, 1980 [cited 2007 Apr 6]. Available from <http://digitalcommons.unl.edu/vpc9/30>
104. Kilonzo B, Mhina J, Sabuni C, Mgone G. The role of rodents and small carnivores in plague endemicity in Tanzania. *Belg J Zool* 2005; 135(Suppl): 119-125.
105. Woldehiwet Z. Q fever (coxiellosis): epidemiology and pathogenesis. *Res Vet Sci* 2004; 77(2): 93-100.
106. Marrie TJ, Schlech WF III, Williams JC, Yates L. Q fever pneumonia associated with exposure to wild rabbits. *Lancet* 1986; 1(8478): 427-429.
107. Pope JH, Scott W, Dwyer R. *Coxiella burnetii* in kangaroos and kangaroo ticks in western Queensland. *Aust J Exp Biol Med Sci* 1960; 38: 17-27.
108. Riemann HP, Behymer DE, Franti CE, Crabb C, Schwab RG. Survey of Q-fever agglutinins in birds and small rodents in Northern California, 1975-76. *J Wildl Dis* 1979; 15(4): 515-523.
109. McQuiston JH, Childs JE. Q fever in humans and animals in the United States. *Vector-Borne Zoonot* 2002; 2(3): 179-191.
110. American Veterinary Medical Association. Q fever background. 2006 [cited 2007 Apr 3]. Available from [http://www.avma.org/public\\_health/biosecurity/qfever\\_bgnd.asp](http://www.avma.org/public_health/biosecurity/qfever_bgnd.asp)
111. Secretariat of the Pacific Community. Q fever [cited 2007 Apr 3]. Available from [http://www.spc.int/rahs/Manual/Multiple\\_Species/QFEVERE.HTM](http://www.spc.int/rahs/Manual/Multiple_Species/QFEVERE.HTM)
112. Webster JP, Lloyd G, Macdonald DW. Q fever (*Coxiella burnetii*) reservoir in wild brown rat (*Rattus norvegicus*) populations in the UK. *Parasitology* 1995; 110(Pt 1): 31-35.
113. Enright JB, Franti CE, Behymer DE, Longhurst WM, Dutson VJ, Wright ME. *Coxiella burnetii* in a wildlife-livestock environment: Distribution of Q fever in wild animals. *Am J Epidemiol* 1971; 94(1): 79-90.
114. Ejercito CL, Cai L, Htwe KK, Taki M, Inoshima Y, Kondo T, et al. Serological evidence of *Coxiella burnetii* infection in wild animals in Japan. *J Wildl Dis* 1993; 29(3): 481-484.
115. Gallagher J, Macadam I, Sayer J, van Lavieren LP. Pulmonary tuberculosis in free-living lechwe antelope in Zambia. *Trop Anim Health Pro* 1972; 4(4): 204-213.
116. Allgood MA, Price GT. Isoniazid therapy of tuberculosis in baboons. *Primates* 1971; 12(1): 81-90.

117. Michel AL, Bengis RG, Keet DF, Hofmeyer M, Klerk LM, Cross PC, et al. Wildlife tuberculosis in South African conservation areas: implications and challenges. *Vet Microbiol* 2006; 112(2-4): 91-100.
118. Serraino A, Marchetti G, Sanguinetti V, Rossi MC, Zanoni RG, Catozzi L, et al. Monitoring of transmission of tuberculosis between wild boars and cattle: genotypical analysis of strains by molecular epidemiology techniques. *J Clin Microbiol* 1999; 37(9): 2766-2771.
119. Cleaveland S, Mlengeya T, Kazwala RR, Michel A, Kaare MT, Jones SL, et al. Tuberculosis in Tanzanian wildlife. *J Wildl Dis* 2005; 41(2): 446-453.
120. Payeur JB, Church S, Mosher L, Robinson-Dunn B, Schmitt S, Whipple D. Bovine tuberculosis in Michigan wildlife. *Ann NY Acad Sci* 2002; 969: 259-261.
121. Pinto MR, Jainudeen MR, Panabokke RG. Tuberculosis in a domesticated Asiatic elephant *Elephas maximus*. *Vet Rec* 1973; 93(26): 662-664.
122. Gorton RJ. A Study of tuberculosis in hedgehogs so as to predict the location of tuberculous possums. Masters thesis, Massey University, NZ, 1998 [cited 2007 Apr 20]. Available from <http://epicentre.massey.ac.nz/Portals/0/EpiCentre/Downloads/Publications/Thesis/RobynGortonMVS.pdf>
123. Martin-Atance P, Palomares F, Gonzalez-Candela M, Revilla E, Cubero MJ, Calzada J, et al. Bovine tuberculosis in a free ranging red fox (*Vulpes vulpes*) from Doñana National Park (Spain). *J Wildl Dis* 2005; 41(2): 435-436.
124. Mangold BJ, Cook RA, Cranfield MR, Huygen K, Godfrey HP. Detection of elevated levels of circulating antigen 85 by dot immunobinding assay in captive wild animals with tuberculosis. *J Zoo Wildl Med* 1999; 30(4): 477-483.
125. Wilson P, Weavers E, West B, Taylor M, Kavanagh J, Jones P. *Mycobacterium bovis* infection in primates in Dublin Zoo: epidemiological aspects and implications for management. *Lab Anim* 1984; 18(4): 383-387.
126. Lewerin SS, Olsson SL, Eld K, Roken B, Ghebremichael S, Koivula T, et al. Outbreak of *Mycobacterium tuberculosis* infection among captive Asian elephants in a Swedish zoo. *Vet Rec* 2005; 156(6): 171-175.
127. University of Wisconsin-Madison – National Primate Research Center. Tuberculosis [cited 2007 Apr 20]. Available from <http://pin.primate.wisc.edu/aboutp/pets/tb.html>
128. Leathers CW, Hamm TE Jr. Naturally occurring tuberculosis in a squirrel monkey and a cebus monkey. *J Am Vet Med Assoc* 1976; 169(9): 909-911.
129. Michel AL. Implications of tuberculosis in African wildlife and livestock. *Ann NY Acad Sci* 2002; 969: 251-255.
130. Cooke MM, Jackson R, Coleman JD. Tuberculosis in a free-living brown hare (*Lepus europaeus occidentalis*). *New Zeal Vet J* 1993; 41(3): 144-146.



131. Delahay RJ, Cheeseman CL, Clifton-Hadley RS. Wildlife disease reservoirs: the epidemiology of *Mycobacterium bovis* infection in the European badger (*Meles meles*) and other British mammals. *Tuberculosis (Edinb)* 2001; 81(1-2): 43-49.
132. Michalak K, Austin C, Diesel S, Bacon JM, Zimmerman P, Maslow JN. *Mycobacterium tuberculosis* infection as a zoonotic disease: transmission between humans and elephants. *Emerg Infect Dis* 1998; 4(2): 283-287.
133. Michel AL. *Mycobacterium tuberculosis*: an emerging disease of free-ranging wildlife. *Emerg Infect Dis* 2002; 8(6): 598-601.
134. Corner LAL. The role of wild animal populations in the epidemiology of tuberculosis in domestic animals: how to assess the risk. *Vet Microbiol* 2006; 112: 303-312.
135. Bunnell JE, Hice CL, Watts DM, Montrueil V, Tesh RB, Vinetz JM. Detection of pathogenic *Leptospira* spp. infections among mammals captured in the Peruvian Amazon Basin region. *Am J Trop Med Hyg* 2000; 63(5,6): 255-258.
136. Richardson DJ, Gauthier JL. A serosurvey of leptospirosis in Connecticut peridomestic wildlife. *Vector-Borne Zoonot* 2003; 3(4) 187-193.
137. Anderson EC, Rowe LW. The prevalence of antibody to the viruses of bovine virus diarrhoea, bovine herpes virus 1, rift valley fever, ephemeral fever and bluetongue and to *Leptospira* sp in free-ranging wildlife in Zimbabwe. *Epidemiol Infect* 1998; 121: 441-449.
138. Fennestad KL, Borg-Petersen C. Leptospirosis in Danish wild animals. *J Wildl Dis* 1972; 8: 343-351.
139. Diesch SL, McCulloch WF, Braun JL, Davis JR. Detection and ecology of leptospirosis in Iowa wildlife. *J Wildl Dis* 1970; 6: 275-288.
140. McKiel JA, Cousineau JG, Hall RR. Leptospirosis in wild animals in eastern Canada with particular attention to the disease in rats. *Can J Comp Med Vet Sci* 1961; 25: 15-18.
141. Sebek Z, Sixl W, Reinthaler F, Abdel-Nabi O, Stunzner D, Schneeweiss W, et al. Leptospirosis in the Melut district-upper Nile province (south Sudan)-an overview. *Geogr Med Suppl* 1989; 5: 161-178.
142. Colegrove KM, Lowenstine LJ, Gulland FMD. Leptospirosis in northern elephant seals (*Mirounga angustirostris*) stranded along the California coast. *J Wildl Dis* 2005; 41(2): 426-430.
143. Stoyanova N, Tokarevich N, Gracheva L, Volkova G, Gracheva N, Kravchenko S, et al. Leptospirosis in north-west Russia. *EpiNorth*. 2004 [cited 2007 Apr 21]. Available from [http://www.epinorth.org/eway/default0.asp?Pid=230&oid=0&e=0&trg=MainArea\\_5260&MainArea\\_5260=5273:44619::1:5262:1:5260;;;10:0:0](http://www.epinorth.org/eway/default0.asp?Pid=230&oid=0&e=0&trg=MainArea_5260&MainArea_5260=5273:44619::1:5262:1:5260;;;10:0:0)

144. Santa Rosa CA, Sulzer CR, Giorgi W, da Silva AS, Yanaquita RM, Lobao AO. Leptospirosis in wildlife in Brazil: isolation of a new serotype in the pyrogenes group. *Am J Vet Res* 1975; 36(9): 1363-1365.
145. Mendoza P, Mayor P, Galvez HA, Cespedes MJ, Jori F. Antibodies against *Leptospira* spp. In captive collared peccaries, Peru. *Emerg Infect Dis* 2007; 13(5): 793-794.
146. de Lisle GW, Almand KB, Julian AF, Wallace J. Leptospirosis in the opossum (*Trichosurus vulpecula*). *New Zeal Vet J* 1975; 23(9): 215-216.
147. Anderson DC, Geistfeld JG, Maetz HM, Patton CM, Kaufmann AF. Leptospirosis in zoo workers associated with bears. *Am J Trop Med Hyg* 1978; 27(1 Pt 1): 210-211.
148. CBWInfo. Factsheets on Chemical and Biological Warfare Agents: Glanders [cited 2007 Apr 22]. Available from <http://www.cbwinfo.com/Biological/Pathogens/BMa.html>
149. Berrada ZL, Goethert HK, Telford SR III. Raccoons and skunks as sentinels for enzootic tularemia. *Emerg Infect Dis* 2006; 12(6): 1019-1021.
150. Zhang F, Liu W, Chu MC, He J, Duan Q, Wu XM, et al. *Francisella tularensis* in rodents, China. *Emerg Infect Dis* 2006; 12(6): 994-996.
151. Morner T, Sandstrom G, Mattsson R, Nilsson PE. Infections with *Francisella tularensis* biovar palaeartica in hares (*Lepus timidus*, *Lepus europaeus*) from Sweden. *J Wildl Dis* 1988; 24(3): 422-433.
152. Audet AM, Robbins CB, Lariviere S. *Alopex lagopus*. *Mammalian Species* 2002; 713: 1-10.
153. Posthaus H, Welle M, Morner T, Nicolet J, Kuhnert P. Tularemia in a common marmoset (*Callithrix jacchus*) diagnosed by 16S rRNA sequencing. *Vet Microbiol* 1998; 61(1): 145-150.
154. Emmons RW, Ruskin J, Bissett ML, Uyeda DA, Wood RM, Lear CL. Tularemia in a mule deer. *J Wildl Dis* 1976; 12(3): 459-463.
155. University of California Santa Barbara - Institutional Animal Care and Use Committee. Zoonotic diseases [cited 2007 Apr 22]. Available from <http://research.ucsb.edu/connect/acc/policy.html>
156. Feldhamer GA, Whittaker JC, Bloemer SR. 2002. Often unseen fauna: small mammals and mesocarnivores on Land between the Lakes. Pp. 421-435 in J. S. Fralish and E. W. Chester, (eds.). *Land Between The Lakes, Kentucky and Tennessee: Four Decades of Tennessee Valley Authority Stewardship*. Austin Peay State University Center for Field Biology, Clarksville, TN [cited 2007 Apr 22]. Available from <http://campus.pc.edu/~jwhittak/Feldhameretal2002.pdf>

157. U. S. Department of Agriculture – Agricultural Research Service. Information resources on the North American opossum (*Didelphis virginiana*): A Bibliography on its natural history and use in biomedical research. Compiled by: Krause WJ [cited 2007 Apr 22]. Available from <http://www.nal.usda.gov/awic/pubs/opossum.htm>
158. Wobeser G, Ngeleka M, Appleyard G, Bryden L, Mulvey MR. Tularemia in deer mice (*Peromyscus maniculatus*) during a population irruption in Saskatchewan, Canada. *J Wildl Dis* 2007; 43(1): 23-31.
159. Koprowski JL. Pine squirrel (*Tamiasciurus hudsonicus*): A Technical conservation assessment. Prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project, 2005 [cited 2007 Apr 22]. Available from <http://www.fs.fed.us/r2/projects/scp/assessments/pinesquirrel.pdf>
160. Beckwith CS. Tularemia as a cause of fever in a squirrel monkey. *J Am Vet Med Assoc* 2006; 229(2): 269-273.
161. Farhang-Azad A, Mescerjakova I, Neronov V. Afghan hedgehog, a new reservoir of tularemia. *Bull Soc Pathol Exot Filiales* 1973; 66(2): 266-269.
162. Jenkins DJ, Macpherson CNL. Transmission ecology of echinococcus in wild-life in Australia and Africa. *Parasitology* 2003; 127: S63-S72.
163. Rodrigues-Silva R, Peixoto JRV, de Oliveira RMF, MagalhaesPinto R, Gomes DC. An Autochthonous case of *Echinococcus vogeli* Rausch & Bernstein, 1972 polycystic echinococcosis in the state of Rondônia, Brazil. *Mem I Oswaldo Cruz* 2002; 97(1): 123-126.
164. Courtenay O, Maffei L. Crab-eating fox *Cerdocyon thous* (Linnaeus, 1766) [cited 2007 Apr 28]. Available from [http://www.canids.org/species/Crab-eating\\_fox.pdf](http://www.canids.org/species/Crab-eating_fox.pdf)
165. MacPherson CN, Karstad L, Stevenson P, Arundel JH. Hydatid disease in the Turkana District of Kenya. III. The significance of wild animals in the transmission of *Echinococcus granulosus*, with particular reference to Turkana and Masailand in Kenya. *Ann Trop Med Parasitol* 1983; 77(1): 61-73.
166. Henttonen H, Fuglei E, Gower CN, Haukisalmi V, Ims RA, Niemimaa J, et al. *Echinococcus multilocularis* on Svalbard: introduction of an intermediate host has enabled the local life-cycle. *Parasitology* 2001; 123: 547-552.
167. Sokolov VE, Lushchekina AA. *Procapra gutturosa*. In *Mammalian Species*, No. 571. American Society of Mammalogists 1997 [cited 2007 Apr 26]. Available from <http://www.jstor.org/view/00763519/ap060706/06a00010/0>
168. Krecek RC, Boomker J, Penzhorn BL, Scheepers L. Internal parasites of giraffes (*Giraffa camelopardalis angolensis*) from Etosha National Park, Namibia. *J Wildl Dis* 1990; 26(3): 395-397.
169. World Organisation for Animal Health – OIE Working Group for Wildlife Diseases. Regional report for Africa, 2005. Compiled by Bengis R [cited 2007 Apr 26]. Available from <http://www.nda.agric.za/vetweb/Animal%20Disease/OIERegionalReportForAfrica2005.pdf>

170. Hamir AN, Smith BB. Severe biliary hyperplasia associated with liver fluke infection in an adult alpaca. *Vet Pathol* 2002; 39(5): 592-594.
171. Bassano B. Sanitary problems related to Marmot-other animals cohabitation in mountain areas. In *Biodiversité chez les marmottes /Biodiversity in marmots*, 1996, Le Berre M., Ramousse R. & L. Le Guelte eds., 75-88.
172. Williams JF, Colli CW. Primary cystic infection with *Echinococcus granulosus* and *Taenia hydatigena* in *Meriones unguiculatus*. *J Parasitol* 1970; 56(3): 509-513.
173. Public Health Agency of Canada. Material Safety Data Sheet – Infectious Substances: *Echinococcus multilocularis* [cited 2007 Apr 26]. Available from <http://www.phac-aspc.gc.ca/msds-ftss/msds55e.html>
174. Tsukada H, Hamazaki K, Ganzorig S, Iwaki T, Konno K, Lagapa JT, et al. Potential remedy against *Echinococcus multilocularis* in wild red foxes using baits with anthelmintic distributed around fox breeding dens in Hokkaido, Japan. *Parasitology* 2002; 125: 119-129.
175. Romano MN, Brunetti OA, Schwabe CW, Rosen MN. Probable transmission of *Echinococcus granulosus* between deer and coyotes in California. *J Wildl Dis* 1974; 10: 225-227.
176. Boussinesq M, Bresson S, Liance M, Houin R. A new natural intermediate host of *Echinococcus multilocularis* in France: the muskrat (*Ondatra zibethicus* L.) [Article in French]. *Ann Parasitol Hum Comp* 1986; 61(4): 431-434.
177. Gonzalez del Solar R, Rau J. Chilla *Pseudalopex griseus* (Gray, 1837) [cited 2007 Apr 26]. Available from <http://www.canids.org/species/Chilla.pdf>
178. D’Alessandro A, Rausch RL, Morales GA, Collet S, Angel D. *Echinococcus* infections in Colombian animals. *Am J Trop Med Hyg* 1981; 30(6): 1263-1276.
179. Bardonnnet K, Benchikh-Elfegoun MC, Bart JM, Harraga S, Hannache N, Haddad S, et al. Cystic echinococcosis in Algeria: cattle act as reservoirs of a sheep strain and may contribute to human contamination. *Vet Parasitol* 2003; 116(1): 35-44.
180. Varma TK, Arora BM, Malviya HC. On the occurrence of hydatid cyst in giant squirrel (*Ratufa indica*). *Indian Vet J* 1995; 72(12): 1305-1306.
181. Machnicka B, Dziemian E, Rocki B, Kolodziej-Sobocinska M. Detection of *Echinococcus multilocularis* antigens in faeces by ELISA. *Parasit Res* 2003; 91(6): 491-496.
182. Boomker J, Horak IG, de Vos V. Parasites of South African wildlife. IV. Helminths of kudu, *Tragelaphus strepsiceros*, in the Kruger National Park. *Onderstepoort J Vet Res* 1989; 56(2): 111-121.
183. Wobeser G. The occurrence of *Echinococcus multilocularis* (Leukart, 1863) in cats near Saskatoon, Saskatchewan. *Can Vet J* 1971; 12(3): 65-68.

184. Bakhvalova VN, Morozova OV, Dobrotvorskiĭ AK, Panov VV, Matveeva VA, Popova RV, Korobova SA. Involvement of the common shrew, *Sorex araneus* (Insectivora, Soricidae), in circulation of the tick-borne encephalitis virus in south-western Siberia [in Russian]. *Parazitologiya* 2001; 35(5): 376-385.
185. Janovsky M, Bacciarini L, Sager H, Grone A, Gottstein B. *Echinococcus multilocularis* in a European beaver from Switzerland. *J Wildl Dis* 2002; 38(3): 618-620.
186. Munday BL. A Serological study of some infectious diseases of Tasmanian wildlife. *J Wildl Dis* 1972; 8(4): 169-175.
187. World Health Organization. WHO Guidelines on tulaeremia. 2007 [cited 2007 Apr 26]. Available from [http://whqlibdoc.who.int/publications/2007/9789241547376\\_eng.pdf](http://whqlibdoc.who.int/publications/2007/9789241547376_eng.pdf)
188. Morvan JM, Deubel V, Gounon P, Nakoune E, Barriere P, Murriss S, et al. Identification of Ebola virus sequences present as RNA or DNA in organs of terrestrial small mammals of the Central African Republic. *Microbes Infect* 1999; 1(14): 1193-1201.
189. Calisher CH, Childs JE, Field HE, Holmes KV, Schountz T. Bats: Important reservoirs of emerging viruses. *Clin Microbiol Rev* 2006; 19(3): 531-545.
190. Klempa B; Tkachenko EA; Dzagurova TK, Yunicheva YV, Morozov V, Okulova NM, et al. Hemorrhagic fever with renal syndrome caused by 2 lineages of Dobrava hantavirus, Russia. *Emerg Infect Dis* 2008; 14(4): 617-625.
191. Coulibaly C, Hack R, Seidl J, Chudy M, Itter G, Plesker R. A natural asymptomatic herpes B virus infection in a colony of laboratory brown capuchin monkeys (*Cebus apella*). *Laboratory Animals* 2004; 38(4): 432-438.
192. Wilson RB, Holscher MA, Chang T, Hodges JR. Fatal herpesvirus simiae (B virus) infection in a patas monkey (*Erythrocebus patas*). *J Vet Diagn Invest* 1990; 2: 242-244.
193. Tu C, Crameri G, Kong X, Chen J, Sun Y, Yu M, et al. Antibodies to SARS coronavirus in civets. *Emerg Infect Dis* 2004; 10(12): 2244-2248.
194. Ward O, Wurster-Hill D. Ecological studies of Japanese raccoon dogs, *Nyctereutes procyonoides*. *J Mammal* 1989; 70: 330-334.
195. Loris-Conservation.org [cited 2007 Apr 27]. Available from <http://www.loris-conservation.org/database/disease/index.htm#diseases>
196. Pattnaik P. Kyasanur forest disease: an epidemiological view in India. *Rev Med Virol* 2006; 16: 151-165.
197. Peters JC. An epizootic of monkey pox at Rotterdam Zoo. *Int Zoo Yearb* 1966; 6: 274-275.
198. Hutin YJF, Williams RJ, Malfait P, Pebody R, Loparev VN, Ropp SL, et al. Outbreak of human monkeypox, Democratic Republic of Congo, 1996 to 1997. *Emerg Infect Dis* 2001; 7(3): 434-438.

199. Smits WTM, Heriyanto, Ramono WS. A New method for rehabilitation of orangutans in Indonesia. In: Nadler RD, Galdikas FM, Sheeran LK, Rosen N, eds. *The Neglected ape*. New York: Plenum Press. 1995. pp. 69-77.
200. Matz-Rensing K, Floto A, Becker T, Finke EJ, Seibold E, Spletstoesser WD, et al. Epizootic of tularemia in an outdoor housed group of cynomolgus monkeys (*Macaca fascicularis*). *Vet Pathol* 2007; 44: 327-334.
201. National Research Council of the National Academies. *Occupational Health and Safety in the Care and Use of Nonhuman Primates*. Washington DC: National Academies Press. 2003.
202. Yimam AE, Nonaka N, Oku Y, Kamiya M. Prevalence and intensity of *Echinococcus multilocularis* in red foxes (*Vulpes vulpes schrencki*) and raccoon dogs (*Nyctereutes procyonoides albus*) in Otaru city, Hokkaido, Japan. *Jap J Vet Res* 2002; 49(4): 287-296.
203. Clemente L, Fernandes TL, Barahona MJ, Bernardino R, Botelho A. Confirmation by PCR of *Coxiella burnetii* infection in animals at a zoo in Lisbon, Portugal. *Vet Rec* 2008; 163: 221-222.
204. Moles-Cervantes LP, Pulido-Reyes J, Banda-Ruiz VM, Luna-Alvarez MA, Galvador-Rosas DG, Torres-Barranca JI. Serological diagnosis of leptospirosis in a giant panda (*Ailuropoda melanoleuca*) in Spanish]. *Tecnica Pecuaria en Mexico* 1994; 32(3): 145-149.
205. Hutson CL, Lee KN, Abel J, Carroll DS, Montgomery JM, Olson VA, et al. Monkeypox zoonotic associations: insights from laboratory evaluation of animals associated with the multi-state US outbreak. *Am J Trop Med Hyg* 2007; 76(4): 757-768.
206. Dierauf LA, Gulland FMD. *CRC Handbook of Marine Mammal Medicine*. Boca Raton: CRC Press, 2001.
207. Foster G, Jahans KL, Reid RJ, Ross HM. Isolation of *Brucella* species from cetaceans, seals and an otter. *Vet Rec* 1996; 138(24): 583-6.
208. Murray DL, Kapke CA, Evermann JF, Fuller TK. Infectious disease and the conservation of free-ranging large carnivores. *Anim Conserv* 1999; 2: 241-254.
209. International Union for Conservation of Nature. Mills MGL and Hofer H, eds. *Hyaenas Status Survey and Conservation Action Plan*. Gland Switzerland: 1998.
210. Nielsen K and Duncan JR. *Animal brucellosis*. Boca Raton: CRC Press, 1990.
211. Towner JS, Pourrut X, Albariño CG, Nkogwe CN, Bird BH, Grard G, et al. Marburg virus infection detected in a common African bat. *PLoS ONE* 2007; 2(8): e764.
212. Food and Agriculture Organization. Avian Flu [cited 2007 Apr 29]. Available from [http://www.fao.org/avianflu/en/wildlife/wild\\_animals.htm](http://www.fao.org/avianflu/en/wildlife/wild_animals.htm)

213. Songserm T, Amonsin A, Jam-on R, Sae-Heng N, Pariyothorn N, Payungporn S. Fatal avian influenza A H5N1 in a dog. *Emerg Infect Dis* 2006; 12(11): 1744-1747.
214. US Geological Survey National Wildlife Health Center. List of species affected by H5N1 (avian influenza) [cited 2007 Apr 29]. Available from [http://www.nwhc.usgs.gov/disease\\_information/avian\\_influenza/affected\\_species\\_chart.jsp](http://www.nwhc.usgs.gov/disease_information/avian_influenza/affected_species_chart.jsp)
215. Prosenec K, Avsic-Zupanc T, Trilar T, Petrovec M, Poljak M. The fat dormouse *Myoxus glis* as a natural host of medically important microorganisms. *Nat Croat* 1997; 6(2): 253-262.
216. Gudan A, Artuković B, Cvetnić Z, Spicić S, Beck A, Hohsteter M, et al. Disseminated tuberculosis in hyrax (*Procavia capensis*) caused by *Mycobacterium africanum*. *J Zoo Wildl Med* 2008; 39(3): 386-391.
217. Koizumi N, Muto M, Yamamoto S, Baba Y, Kudo M, Tamae Y, et al. Investigation of reservoir animals of *Leptospira* in the northern part of Miyazaki Prefecture. *Jpn J Infect Dis* 2008; 61(6): 465-8.
218. Cornide RI, Cabrera L. [Detection of *Leptospira* antibodies in Hutia (*Mysateles* spp.)] [Article in Spanish] *Miscelánea Zoológica*. 1984; 22: [pages not cited]. Reference within *Monografias.com*: "*Leptospira interrogans*." [Cited 2009 Feb 26]. Available from <http://www.monografias.com/trabajos25/leptospira-interrogans/leptospira-interrogans.shtml>
219. Pioz M, Loison A, Gauthier D, Gibert P, Jullien JM, Artois M, et al. Diseases and reproductive success in a wild mammal: example in the alpine chamois. *Oecologia* 2008; 155(4): 691-704.
220. Maratea J, Ewalt DR, Frasca S Jr, Dunn JL, De Guise S, Szkudlarek L, et al. Evidence of *Brucella* sp. infection in marine mammals stranded along the coast of southern New England. *J Zoo Wildl Med* 2003; 34(3): 256-61.
221. Blasdell KR, Becker SD, Hurst J, Begon M, Bennett M. Host range and genetic diversity of arenaviruses in rodents, United Kingdom. *Emerg Infect Dis* 2008; 14(9): 1455-1458.
222. Normile D. Scientists puzzle over Ebola-Reston virus in pigs. *Science* 2009; 323(5913): 451.
223. Swanepoel R, Smit SB, Rollin PE, Formenty P, Leman PA, Kemp A, et al. Studies of reservoir hosts for Marburg virus. *Emerg Infect Dis* 2007; 13(12): 1847-1851.
224. Shi Z, Hu Z. A review of studies on animal reservoirs of the SARS coronavirus. *Virus Res* 2008; 133: 74-87.

225. Greenwood AG, Sanchez S. Serological evidence of murine pathogens in wild grey squirrels (*Sciurus carolinensis*) in North Wales. *Vet Rec* 2002; 150(17): 543-6.
226. Serra-Cobo J, Amengual B, Abellán C, Bourhy H. European bat lyssavirus infection in Spanish bat populations. *Emerg Infect Dis* 2002; 8(4): 413-20.
227. Paweska JT, Blumberg LH, Liebenberg C, Hewlett RH, Grobbelaar AA, Leman PA, et al. Fatal human infection with rabies-related Duvenhage virus, South Africa. *Emerg Infect Dis* 2006; 12(12): 1965-7.
228. Pfukenyi DM, Pawandiwa D, Makaya PV, Ushewokunze-Obatolu U. A retrospective study of wildlife rabies in Zimbabwe, between 1992 and 2003. *Trop Anim Health Prod.* 2008 Aug 30; [Epub ahead of print].
229. Li Y, Wang J, Hickey AC, Zhang Y, Li Y, Wu Y, et al. Antibodies to Nipah or Nipah-like viruses in bats, China. *Emerg Infect Dis* 2008; 14(12): 1974–1976.
230. Lednicky JA. Hantaviruses: A short review. *Arch Pathol Lab Med* 2002; 127(1): 30-35.
231. McNamara T, Linn M, Calle P, Cook R, Karesh W, Raphael B. Leptospirosis: an under-reported disease in zoo animals? *Verh ber Erkrig Zootiere* 1999; 39: 185-188.
232. McCall BJ, Epstein JH, Neill AS, Heel K, Field H, Barrett J, et al. Potential human exposure to Australian bat lyssavirus, Queensland, 1996-1999. *Emerg Infect Dis* 2000; 6(3): 259-264.
233. International Committee on Taxonomy of Viruses. The universal database of the International Committee on Taxonomy of Viruses [cited 2009 September 19]. Available from <http://www.ncbi.nlm.nih.gov/ICTVdb>
234. Cousins DV, Bastida R, Cataldi A, Quse V, Redrobe S, Dow S, et al. Tuberculosis in seals caused by a novel member of the *Mycobacterium tuberculosis* complex: *Mycobacterium pinnipedii* sp. nov. *Int J Syst Evol Micr* 2003;53:1305–14.