

Chapter 4

Zoonoses and Travel

“The movement of populations shapes the patterns and distribution of infectious diseases globally.” (Wilson)¹



Photo by Milton Friend

Contents

Exposure to Zoonoses.....	193
Box 4–1 Working Together to Combat Zoonoses.....	196
Travel, Zoonotic, and Other Infectious Diseases	201
Literature Cited	204

Bolded words within the text indicate terms that are defined in the Glossary.

Chapter 4

Zoonoses and Travel

The escalating speed of transportation expands the global mobility of society, allows many products and services to be rapidly obtained anywhere in the world, and promotes the explosive growth of tourism (Fig. 4.1). Ecotourism is especially popular. Within a single day's time, people can travel to rural and remote areas where there are unique and often concentrated collections of wildlife. When traveling to these areas, people can be exposed to pathogens not common in their home location.¹⁻³ Timely and accurate diagnoses of the pathogens involved are often essential to prevent life-threatening stages of disease from developing. Also, travelers who contract infections can serve to initiate epidemics (e.g., SARS) (Fig. 4.2). This chapter focuses on travel as a factor in exposure to zoonoses and other factors potentially confounding diagnoses.

Infections that travelers can obtain while far from home can complicate timely diagnoses. Travelers may also unknowingly bring home exotic pathogens through foods and other products. When local medical practitioners are taking a medical history, they may forget to ask, or the patient may forget to offer information about previous travel or exposures through other unusual means (Box 4-1). Some medical practitioners may have little familiarity with the pathogen involved or little reason to consider that pathogen without the patient offering adequate historical perspective. The medical practitioner may miss the diagnosis because of the similarity in clinical signs and symptoms that are associated with multiple diseases, especially during early stages of illness. Thus, the primary objectives for this chapter are: (1) to raise general awareness of human activities for which exposure to zoonoses may be underappreciated, and (2) to provide guidance for individuals seeking medical assistance that may help with timely and accurate diagnoses.

Exposure to Zoonoses

Because of the different types of exposure that people have with animals, there are many pathways for exposure to zoonoses while traveling. With well-known or understood direct pathways for disease transmission, such as animal bites and rabies, physicians and other health-care providers are likely to recognize specific disease concerns. Other exposure pathways are often less obvious, and neither physician nor patient may recognize or appreciate risk factors or potential exposures associated with human/wildlife/environmental connections (Fig. 4.3). Failure of the traveler to identify and disclose those situations can greatly complicate disease diagnoses when the pathogens involved may not exist in the geographic area

where medical assistance is sought. In addition, an increasing number of pathologic agents of animal origin have not historically been human health concerns, yet may be emerging or resurging causes of disease in immunocompromised people. This trend is likely to continue in the world's developed nations where there is a large aging human population and many people are treated for cancers and/or receive organ transplants. In developed and developing nations, infants also may be at risk, due to being immunocompromised or unvaccinated. The AIDS pandemic and tuberculosis are just two diseases involving immunocompromise that have emerged and resurged in recent history.

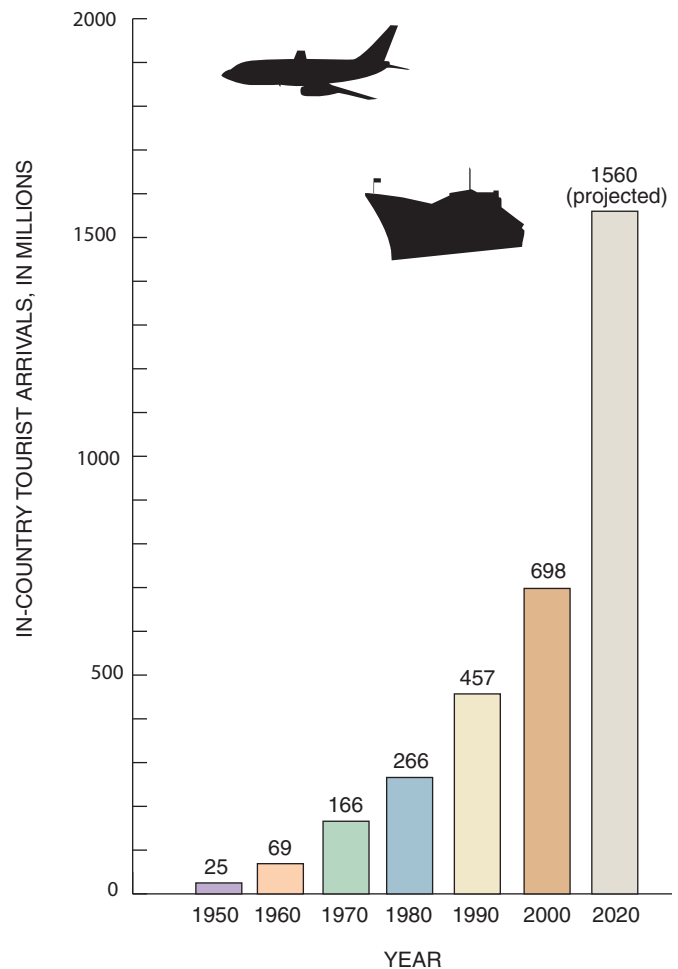


Figure 4.1 Tourism is the fastest growing industry worldwide, and the number of in-country arrivals is projected to double by the year 2020.

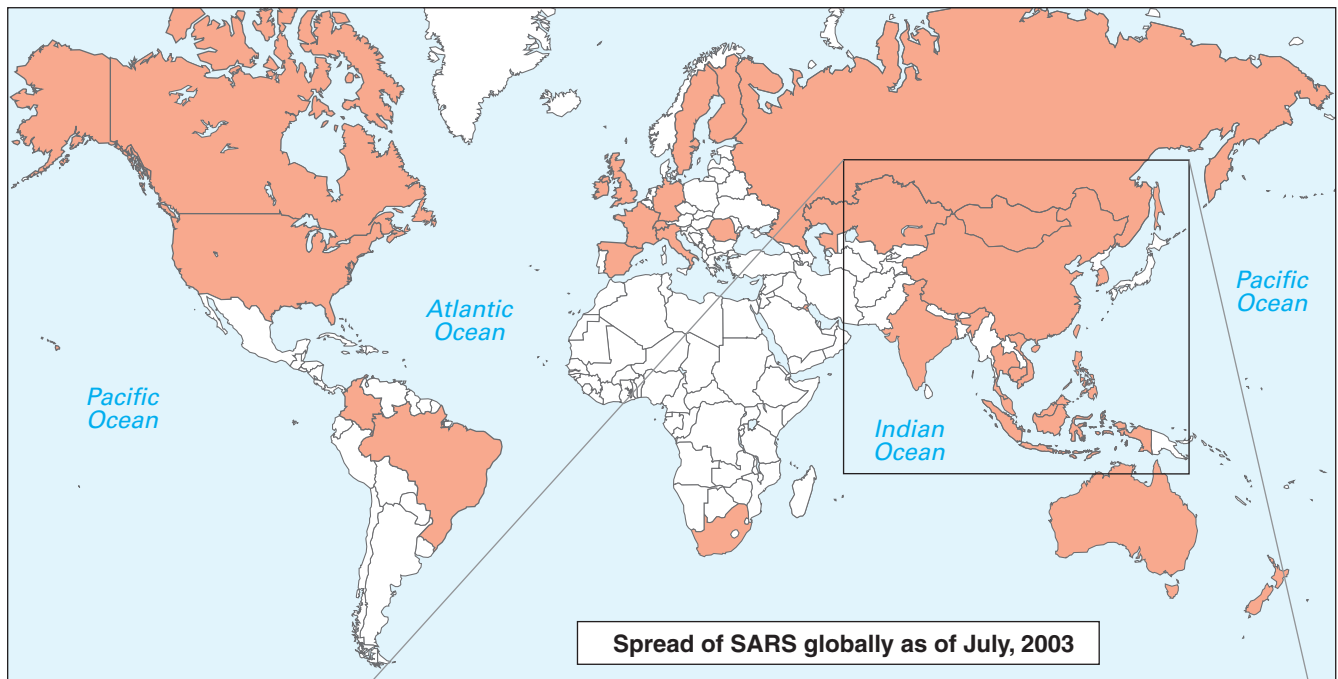


Figure 4.2 Reported global distribution of SARS by July 2003 following the November 2002 eruption of this disease in rural China.³²

EXPLANATION

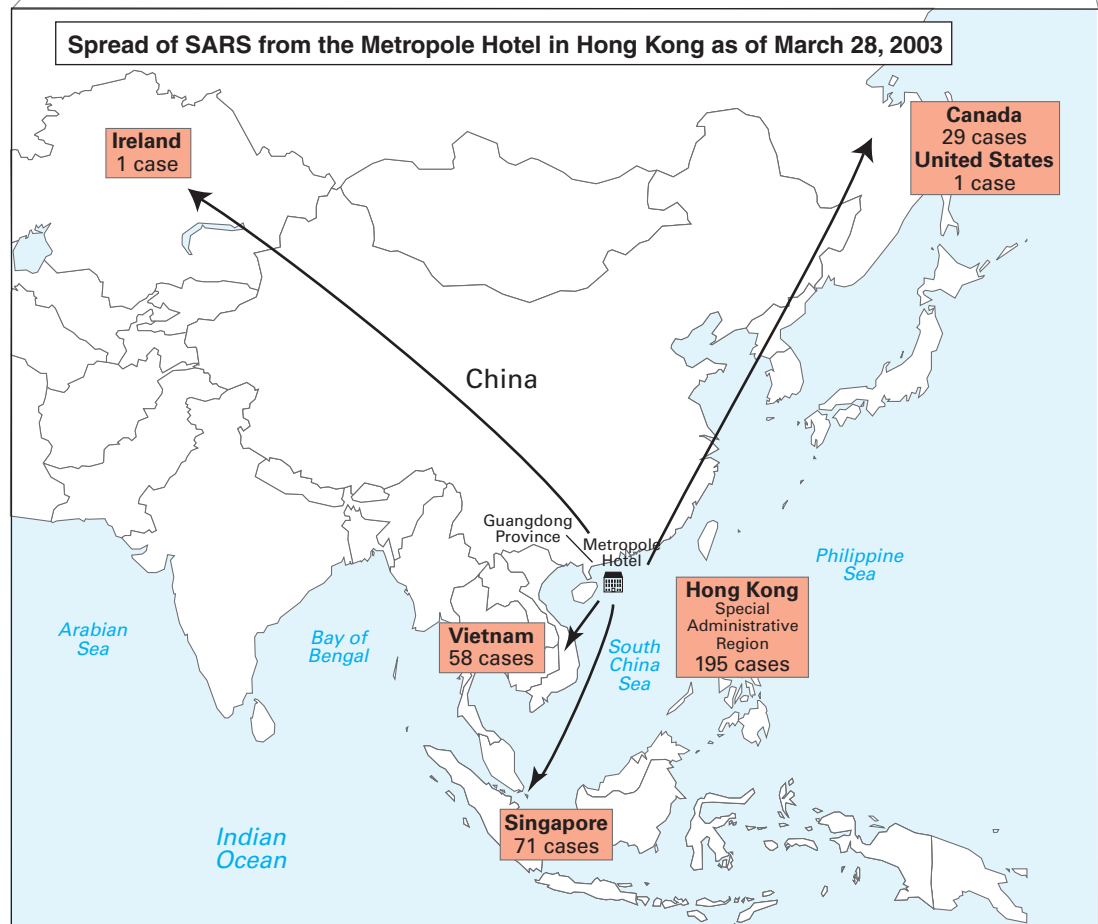
Countries with SARS cases

- Canada
- USA
- Columbia
- Brazil

- Finland
- Sweden
- Ireland
- UK
- Spain
- Germany
- France
- Switzerland
- Italy
- Romania

- Russia
- Mongolia
- China
- India
- Kuwait
- South Africa
- Thailand
- Vietnam
- Singapore

- Malaysia
- Indonesia
- South Korea
- Taiwan
- Hong Kong S.A.R.
- Macau S.A.R.
- Philippines
- Australia
- New Zealand



Direct Pathways

From a perspective of disease transmission, exposure to domestic animals and wildlife is potentially of greater significance in remote areas of developing countries than in urban areas of industrialized countries. However, the worldwide occurrence of infectious disease emergence and resurgence during recent decades results in a need for increased vigilance, risk assessment, and prediction of zoonotic diseases. Currently, even direct pathways for disease transmission are greatly underreported. For example, despite concerns such as rabies, it is thought that less than 50 percent of the more than 1 million animal bites in the USA annually are reported.⁴ Abrasions from scratches caused by animals probably have an even greater rate of underreporting.

Familiarity with the animal (pet or wild animal), its immunizations, and the severity of the wound from the animal are factors that influence the traveler's decision to seek medical assistance, and thus report the incident. In general, people are more likely to seek treatment for a bite or scratch from a wild animal than from a pet. Furthermore, an increasing body of evidence indicates that rabies is transmitted to humans by insectivorous and vampire bats, but people may be unaware that they have been bitten, especially during sleep.⁵

Although less than 1 percent of animal bite wounds in the USA involve wildlife (captive and free-living), infections caused by a variety of pathogens have resulted⁴ (Table 4.1). Some of these, such as **cat** scratch fever, are specifically associated with domestic animals. Although biological transmission of *Bartonella henselae* and several other *Bartonella* spp. typically involve bites by the cat flea, mechanical transmission to humans is associated with cat bites and scratches. In those instances, the cat's teeth and claws have been contaminated by flea feces.⁶ In contrast, infections acquired from *Pasteurella multocida* may be acquired from a broad spectrum of animal species and by other means in addition to animal bites.⁴

Most zoonoses are acquired by pathways other than animal bites; bites from ticks, mosquitoes, and fleas are examples. Direct contact with infectious tissues, body fluids, and secretions or excretions is primarily an occupational hazard of animal disease investigators, wildlife rehabilitators, or processors of animals (butchers, etc.). Hunters, trappers, fishermen, biologists, and others that may only have contact with animals that appear healthy, are at lower risk. These individuals may forget or dismiss associations between their handling of wildlife and personal illness, even though sufficient human illness has been documented from animal contact.

The handling of wildlife or "pocket" pets, such as gerbils, hamsters, and guinea pigs, is an additional potential source of contact transmission and/or exposure to pathogens while traveling or at home. Table 4.2 provides a few examples from many documented cases of disease resulting from

direct contacts with live animals and animal tissues. Indirect transmission can involve such common situations as contact with contaminated water for aquaria (e.g., *Mycobacteria*), aerosol transmission of psittacosis (ornithosis) by feather dander, and salmonellosis from human contact with surfaces contaminated by pet reptile and bird feces (see Chapter 2).

Exposure to pathogens through the consumption of game meat and foods is briefly addressed here; see Chapters 2, 3, and 5 for more in-depth discussion of this topic. Moore and others state, "The ease of international travel in the 21st Century has resulted in persons from Europe and other western countries traveling to distant areas of the world and returning with an increasing array of **parasitic infections** rarely seen in more temperate zones." They report on **gnathostomiasis** as an emerging imported disease in the UK, "the rarity of the condition in areas in which the condition is not endemic might lead to diagnoses being overlooked." They also note that the increasing geographic distribution of infections by *Gnathostoma spinigerum* and other parasites, along with the adventurous eating habits of travelers, are likely to result in an increased incidence of this disease.²

Indirect Pathways

Humans are exposed to zoonotic pathogens by a variety of indirect pathways, including contact with contaminated environments (Fig. 4.3). These pathways for infection are often associated with wilderness travel or "adventure travel." Included within this category are types of "eco-challenge" and "extreme" multisport athletic and "reality television" events held throughout the world. A recent leptospirosis outbreak among international competitors in Malaysian Borneo had an attack rate of nearly 50 percent, with a hospitalization rate of 36 percent, despite the young age and fitness of these endurance athletes.³ Other outbreaks of this bacterial disease have occurred in association with white-water rafting in Costa Rica,⁷ swimming on Oahu, Hawaii,⁸ and among triathletes who swam in lakes in Wisconsin and Illinois, USA.⁹ Exposure to the leptospira organisms in all of these events was most likely due to contact with, or inadvertent ingestion of, contaminated waters.

Some consider leptospirosis as the zoonosis with the widest geographical distribution. A wide variety of domestic and wild animals, such as dogs, sea lions, and rats, are reservoirs for infection and can shed these spirochete organisms in their urine (Fig. 4.4); however, leptospira are very sensitive to dry conditions. They require moist soil, standing water, or surface waters to maintain their virulence and persistence outside their animal hosts.¹⁰ Contact with these contaminated substrates has resulted in many human cases of leptospirosis in divers, swimmers, canal workers, and adventure tourists traversing swamps and jungles, in addition to eco-challenge athletes and more traditional means of exposure.¹¹

Box 4–1 Working Together to Combat Zoonoses

Travel to exotic places may result in exposure to uncommon pathogens not widely recognized within the medical community. The following information is for health-care providers and patients alike, in order to accurately and rapidly determine diagnosis and treatment.

For health-care professionals: Questions to ask	For travelers/wildlife or animal-care professionals/wildlife hobbyists: Information to provide
<p>When taking a patient's history, include at least the first two questions below in order to address occupational and/or travel-related illness.</p> <ul style="list-style-type: none"> • Do you have any medical problems which may cause you to be immunocompromised (cancer, chemotherapy, liver disease, transplants, HIV, AIDS, or any medications for rheumatoid arthritis or asthma)? • In the last year, have you traveled to any exotic or unusual locations outside of your home region? If so, what kind of activities did you do there (e.g., kayaking, swimming, fishing, hunting, hiking, visits to farms, zoos, or wilderness areas)? • Have you in the last year suffered from any fever of unknown origin? • Do you work with or come in contact with any terrestrial or aquatic wildlife, invertebrates, or other animals? • Do you spend considerable time outdoors in your regular daily activities? • Do you wear protective clothing when working with animals and/or when working outdoors? • Have you been bitten by any insect or animal, possibly when you were unaware (e.g., have you awakened to find a welt or bite anywhere on your body)? • Have you noticed any type of allergic reaction to anything you have come into contact with in recent history (e.g., plants, pelts, food products, gifts made from animal parts)? • Can you remember if you had any open cuts or wounds while on your travels or while working with animals during the last year? • Do you remember coming in contact with any aerosol from any wildlife, animals (e.g., being sneezed on, collecting samples from a blowhole, inhaling the expiring breath of hunted wildlife)? 	<p>Before relaying your symptoms, tell your physician your profession/hobby and that you travel worldwide. Each time you are ill and visit your physician's office, remind them. Inform your physician about:</p> <ul style="list-style-type: none"> • Any medical problems that may make you immunosuppressed (e.g., cancer, chemotherapy, liver diseases, transplants, HIV, AIDS). • Any foreign travel you have taken in the last year. • Whether you have visited any unusual locations where you may have been near wildlife, alive or dead, or had close contact with any aquatic or terrestrial animals (e.g., farms, zoos, wildlife or conservations areas, or watersports). • The circumstances by which you may have come in contact with any animals, fish, invertebrates, or plants (e.g., did you go hunting, or clamming, etc., did you investigate any invertebrates/plant interactions, did you explore any tidepools). • Any other wild or domestic animal products/ samples you may have come in contact with (e.g., cleaning a carcass, collecting blood samples, tracking wildlife, viewing, examining scat). • Any indirect terrestrial and/or aquatic wildlife contact you may have had during your travels (e.g., aerosol inhalation, insect infestations, tents with inadequate mosquito netting, eating of bushmeat, handling of pelts/hides). • Whether you remember having any open wounds, welts, or cuts during your travels or occupational activities.

Table 4.1 Examples of human infections resulting from bites and scratches from wildlife (adapted from Krauss et al.¹¹ and Weber and Hansen⁴).









Pathogen type	Wildlife species										
	Alligator	Lizards	Snakes	Fish	Birds	Rats/Mice	Hamsters	Squirrels	Opossum	Seals	Other
BACTERIA (GENUS)^a											
<i>Acinetobacter</i>	●	○	○	○	○	○	●	○	○	○	
<i>Aeromonas</i>	●	○	○	●	○	○	○	○	●	○	
<i>Bacteroides</i>	●	○	●	○	●	○	○	○	○	○	
<i>Citrobacter</i>	●	○	●	●	○	○	○	○	●	○	
<i>Clostridium</i>	●	○	●	●	●	○	○	○	○	○	
<i>Corynebacterium</i>	●	○	●	○	○	●	○	○	○	○	●
<i>Enterobacter</i>	●	○	●	○	○	○	○	○	○	○	○
<i>Erysipelothrix</i>	○	○	○	●	○	○	○	○	○	○	●
<i>Escherichia</i>	○	○	○	○	○	○	○	○	○	○	●
<i>Francisella</i>	○	○	○	○	○	○	○	○	○	○	●
<i>Fusobacterium</i>	●	○	○	○	○	●	○	○	○	○	○
<i>Leptospira</i>	○	○	○	○	○	●	●	○	○	○	○
<i>Micrococcus</i>	○	○	●	●	○	○	○	○	○	○	○
<i>Pasteurella</i>	●	○	●	○	●	●	○	●	●	○	○
<i>Proteus</i>	●	○	●	○	○	○	○	○	○	○	○
<i>Pseudomonas</i>	●	○	●	●	○	○	○	○	○	○	○
<i>Serratia</i>	●	●	○	○	○	○	○	○	○	○	○
<i>Spirillum</i>	○	○	○	○	○	●	○	○	○	○	○
<i>Staphylococcus</i>	○	●	●	●	○	○	○	●	●	○	○
<i>Streptococcus</i>	○	○	●	○	●	●	○	●	●	○	○
<i>Vibrio</i>	○	○	○	●	○	○	○	●	○	○	○
FUNGI (GENUS)											
<i>Aspergillus</i>	●	○	○	○	●	○	○	○	○	○	○
VIRAL DISEASE^b											
Rabies	○	○	○	○	○	○	○	○	○	○	○
											● Bats, canids, skunks, others
Lymphocytic choriomeningitis (LCM)	○	○	○	○	○	●	●	○	○	○	○
Herpes Type B	○	○	○	○	○	○	○	○	○	○	○
Monkeypox	○	○	○	○	○	○	○	○	○	○	○
											● Monkeys, prairie dogs

^a For species and a more complete tally see Krauss et al.¹¹

^b Examples only, other viruses have been transmitted by animal bites.

- Human infections documented
- Human infections not reported

Table 4.2 Examples of human infections acquired from handling wildlife (non-bite or scratch exposures)^a.

Disease	Agent type	Wildlife involved	Comments
Streptothricosis <i>Dermatophilus congolensis</i>	Fungus	White-tailed deer 	Biologist examining hunter-killed deer developed infection on his hands. First documentation of transmission from wildlife. ¹⁹
Ornithosis <i>Chlamydia psittaci</i>	Bacteria	Waterbirds 	Wildlife disease investigators conducting field investigations involving other diseases contracted life-threatening illness. Snow geese and/or sandhill cranes were thought to be the probable sources for infection. ²⁰
Erysipelothrix <i>Erysipelothrix rhusiopathiae</i>	Bacteria	Marine animals 	Handlers of marine mammals have become infected during standing and other rescue and rehabilitation activities. ²¹ Following the field necropsy of a marine bird found dead along an east coast beach (USA), an author (M. Friend) became infected.
Salmonellosis <i>Salmonella</i> spp.	Bacteria	Iguanas, turtles 	Pet turtles have been a major source of salmonellosis in North America and elsewhere. The increased popularity of the green iguana and other lizards as pets has contributed numerous human cases of salmonellosis in North America, including the appearance of novel strains of this bacteria. ^{22–24}
Melioidosis <i>Burkholderia (Pseudomonas) pseudomallei</i>	Bacteria	Marine mammals 	A veterinarian working at an aquarium in China contracted melioidosis while unknowingly inhaling a whale's expiration during blowhole sampling. The causative agent has also been documented to be present in air during Hong Kong monsoons. ²⁵
Monkeypox Orthopoxvirus	Virus	Prairie dogs 	Handling of prairie dogs purchased in the pet trade that became infected from imported rodents initially housed with them resulted in the first presence of this disease in North America. Numerous human cases have occurred in several states within the USA. ²⁶
AIDS Human immunodeficiency viruses (HIV-1, HIV-2)	Virus	Primates 	The harvest of primates and processing of meat from those animals is believed to be the origin of the viruses that crossed over and adapted to humans who then served to spread these human immunodeficiency viruses (HIV-1 and HIV-2) globally. ^{27–30}
“Seal finger” <i>Mycoplasma</i> spp.	Bacteria	Whales, seals, polar bear 	Long-standing occupational disease of those involved with the commercial harvesting of seals and whales; also prevalent among Canadian Inuit and among seal trainers (see Box 2–9).

^a These few examples are from a long list of diseases and circumstances that could be cited. Animal handlers must use protection when handling wildlife and have a general understanding of the disease risks involved.

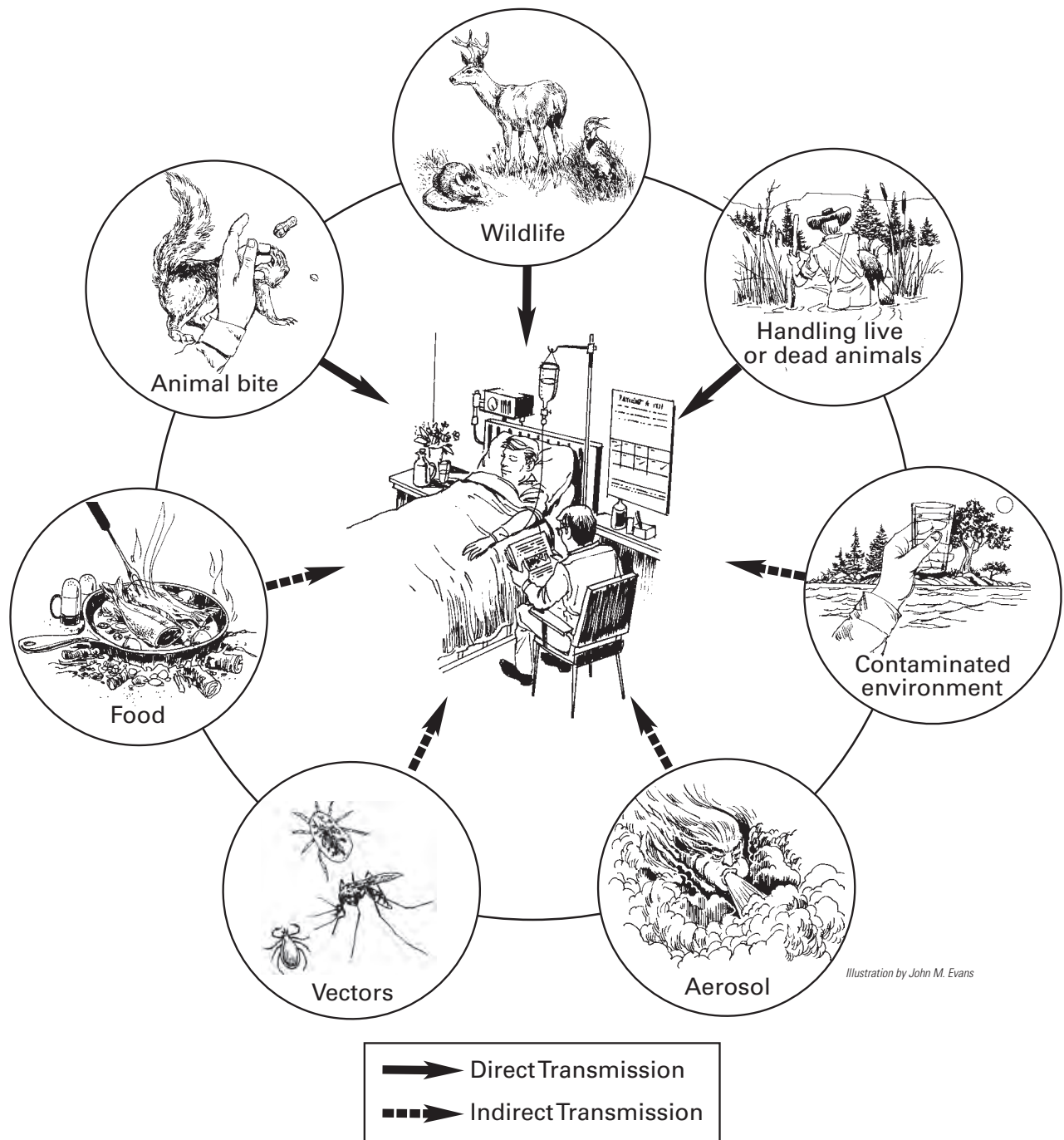
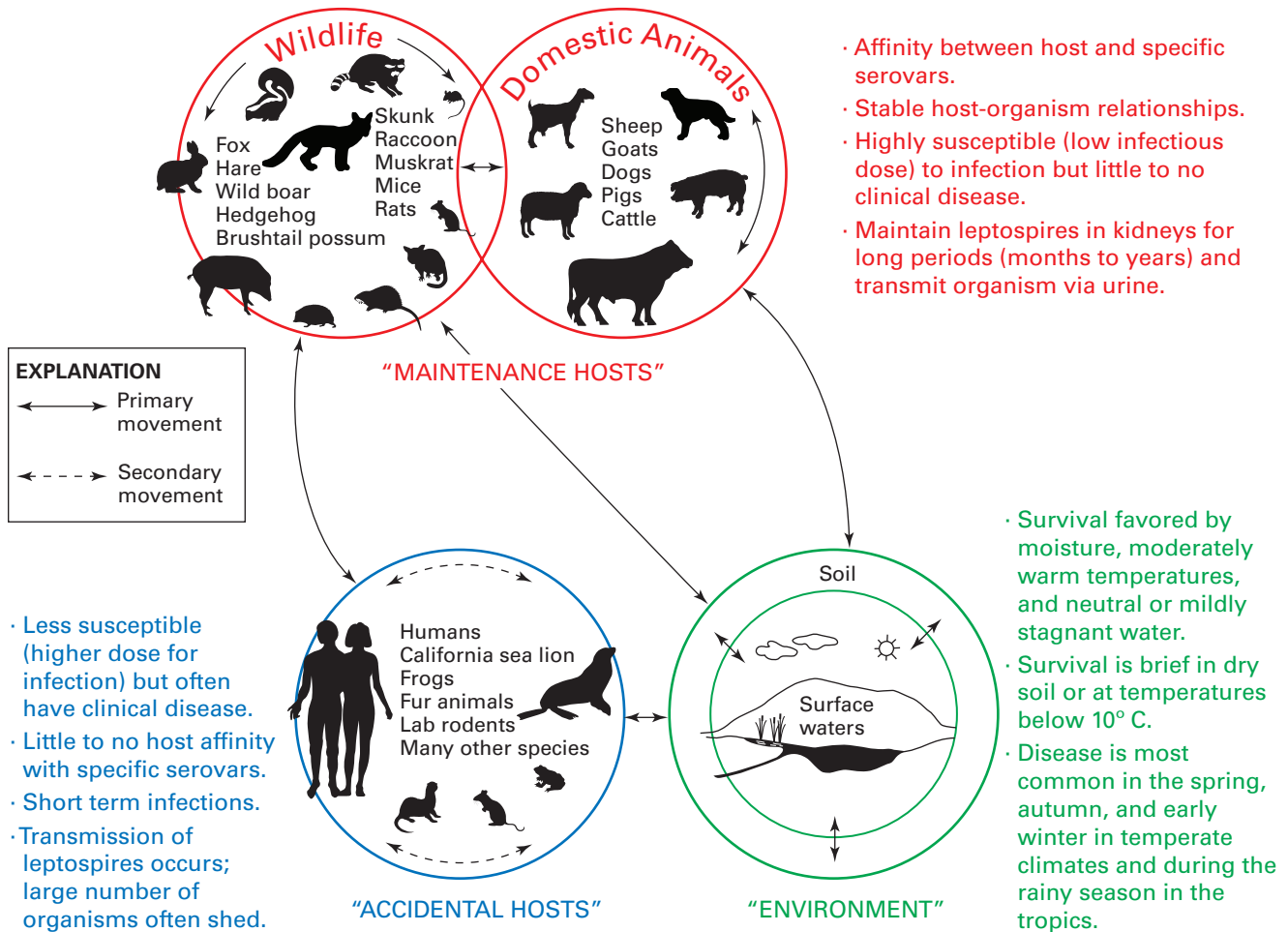


Figure 4.3 Common routes for potential transmission of infectious diseases between animals and humans and vice versa.

LEPTOSPIROSIS

- Acute, systemic, bacterial infection caused by approximately 200 serovars (variants) of *Leptospira interrogans*.
- Worldwide distribution; zoonoses with the widest geographical distribution.
- Humans, domestic animals, California sea lion among species commonly affected.



- Dynamic epidemiology with constant shifts in host-agent relations altering relative importance of available hosts.
- Shifts of the most important host for human cases between domestic animals (e.g., cattle, dogs) and various rodents is common.
- Humans are always accidental hosts, thus are not important for maintenance of infection.
- Human infection primarily occurs through wet or abraded skin, ingestion, and through the mucous membranes of the mouth, conjunctive, or genital tract.
- Among those at greatest risk are agriculture workers, veterinarians, dog breeders, abattoir workers, butchers, people handling raw meat, cooks, dog owners, hunters, animal trappers, sewage workers, rural dwellers, wildlife biologists, farmers, wildlife rehabilitators, zookeepers, ecotourists, and eco-challenge athletes.

Figure. 4.4 Leptospirosis: a worldwide disease of many species and bacterial variants.

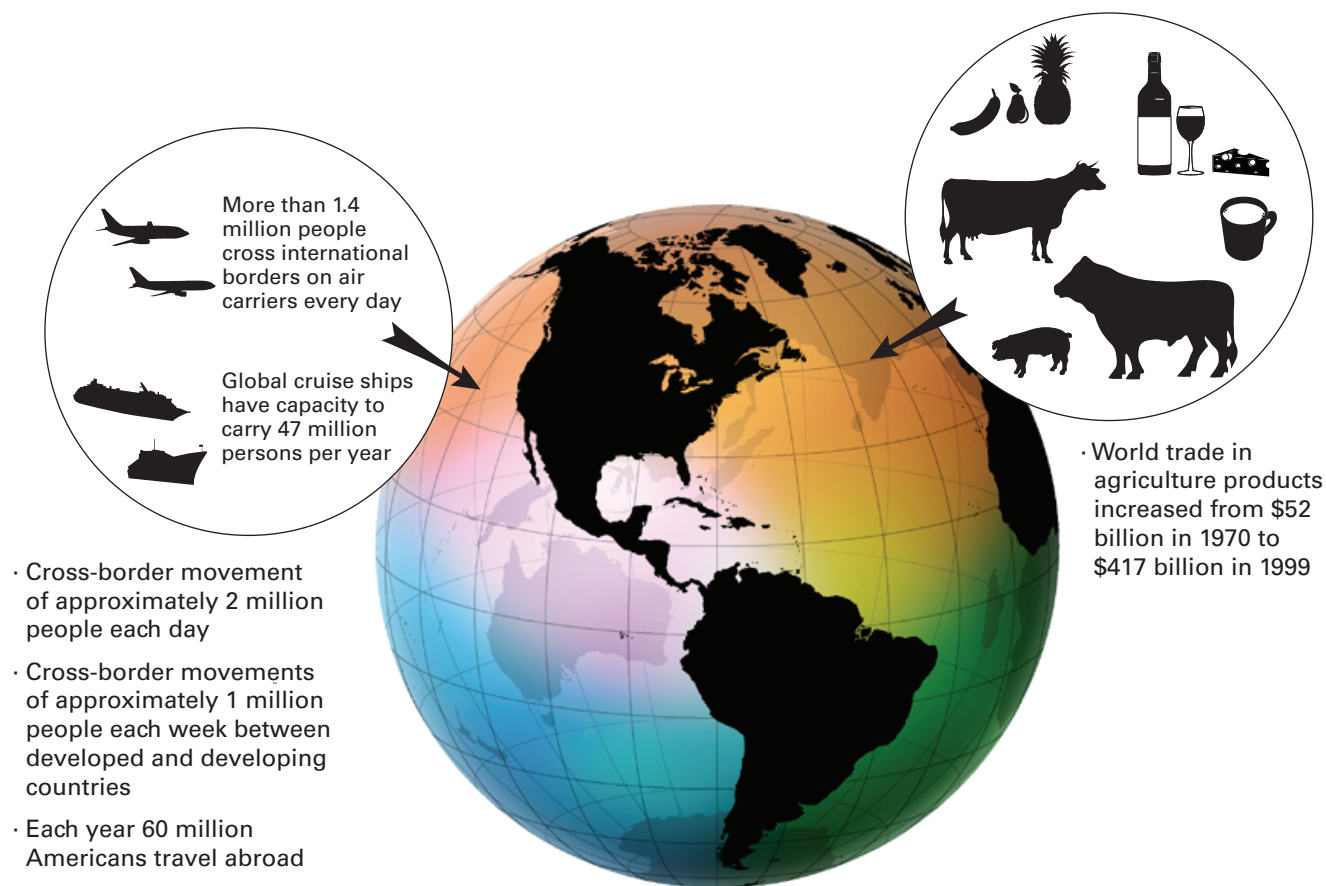


Figure 4.5 Tourism and commerce: cornerstones for “A World of Movement.”

Leptospirosis is but one example of the changing pattern for some established zoonotic diseases due to changes in human activities and mobility. Other zoonoses also are becoming reestablished and novel zoonoses are appearing. Clearly, the task of protecting humans from these diseases is becoming more complex than it was historically. The human patient and the medical community each have important roles to play and contributions to make in this arena. Only by addressing and diagnosing zoonotic diseases in patients who are exposed while in unique situations or surroundings will we be able to prevent, control, or suppress the expansion and establishment of such diseases.

Travel, Zoonotic, and Other Infectious Diseases

About 60 million Americans travel abroad each year.³ Around the world, more than 1.4 million persons cross international borders on air carriers everyday.¹ In 2000, the total numbers of international arrivals worldwide reached nearly 700 million, and the World Tourism Organization estimates that number to increase to more than 1.5 billion by 2020 (Fig. 4.1).¹² In addition to airline travel, cruise ships can carry 47

million passengers per year¹ (Fig. 4.5). This global mobility of humans leads to the potential contracting and spreading of infectious diseases, the rapid change in disease distribution patterns,¹³ and requires us to consider infectious diseases of humans from a global perspective.¹⁴

The situation of the human traveler and emerging or resurging zoonotic disease is somewhat analogous to the “canary in the coal mine.” The canary is a sensitive indicator and an in situ monitor for air quality required to sustain human life. The health status of human travelers has become an index for emerging infections. However, unlike the caged canary in the mine, the traveler serves as sentinel, courier, and transmitter for emerging diseases.¹ This salient human effect extends beyond the health of any individual and far beyond the geographic location where clinical disease may be observed in that individual. “The traveler can be seen as an interactive biological unit who picks up, processes, carries and drops off microbial genetic material. A traveler can introduce potential pathogens in the absence of signs or symptoms.”¹¹ These concepts apply to all infectious agents (e.g., diseases caused by parasites, microbial agents, and possibly, even prions), not just those that are also zoonoses. Thus, global commerce, human travel, emigration, and

Table 4.3 Some information sources addressing travel medicine.

Source	Type	Program	Comments
National Center for Infectious Diseases (CDC)	Web site	Travelers' Health	Provides health information on specific destinations, notices of disease outbreaks, and a variety of other relevant information. Links expand coverage and information for specific topics. Visit http://www.cdc.gov/travel/
National Center for Infectious Diseases	Web site	Travelers' Health	Information on travel-related diseases with links to specific topics. Visit http://www.cdc.gov/travel/diseases.htm
World Health Organization	Web site	International Travel and Health	A compendium of information that can be accessed by country and disease. The focus is on health risks likely to be encountered at specific destinations relative to different types of travel from business to backpacking and adventure tours. Visit http://www.who.int/ith/
Travel Health Care	Web site	Travel Health Information	General information about staying healthy when traveling, diseases of that region, and general travel advice. Visit http://www.travelhealth.com.au/Travel_Health/Travel_Information.html
Wilderness Medical Society	Web site	Wilderness medical issues	Educational programs and publications addressing medical problems encountered in wilderness situations. Membership organization focused on health professionals. Visit http://www.wms.org/
International Society of Travel Medicine	Disease surveillance	Geo Sentinel	Global surveillance network of 26 travel and tropical medicine clinics in the USA, UK, Australia, Canada, Germany, Israel, Italy, Nepal, New Zealand, and Switzerland. Geo Sentinel network members are International Society of Travel Medicine provider clinics that serve as a rapid notification system for significant diagnoses of unusual disease events. Visit http://www.istm.org/
Other	Web site	Traveler's health care	A variety of subscriber programs can be found on the Internet for obtaining pre-travel information, arranging for immunizations, obtaining medical services in various countries, and ordering publications.
"Atlas of Travel Medicine and Health" ³¹	Book	BC Decker, Hamilton, Ontario, Canada	Basic information for pre-travel planning. Addresses general risks and precautions; descriptions and maps of specific diseases; county specific information for important disease and popular destinations.
"Traveller's Health: How to Stay Healthy Abroad," 4 th edition ¹⁸	Book	Oxford University Press, United Kingdom	Comprehensive book (75 chapters) written by subject matter experts. Intended for all audiences from general public to health professionals.
Centers for Disease Control and Prevention	Book	The Yellow Book "Health Information for International Travel." 2003–2004	Published every 2 years by CDC as a reference for those who advise international travelers on health risks; available for purchase: http://bookstore.phf.org/cat24.htm . On-line edition is periodically updated: http://www.cdc.gov/travel/yb/index.htm
Other	Books, journals	Traveler's health, emerging diseases, updates of disease status	A variety of books and scientific journals developed to provide information for professionals in the health field are available for purchase and subscription. Other publications are intended for general audiences. When considering purchase or subscription, take into account the dynamic nature of disease occurrence and scientific knowledge. Information should be as current as possible and developed by authoritative sources.
Personal health care provider	Contact visit	Health care	Many physicians have access to online programs where they can obtain specific information for you relative to your travel.

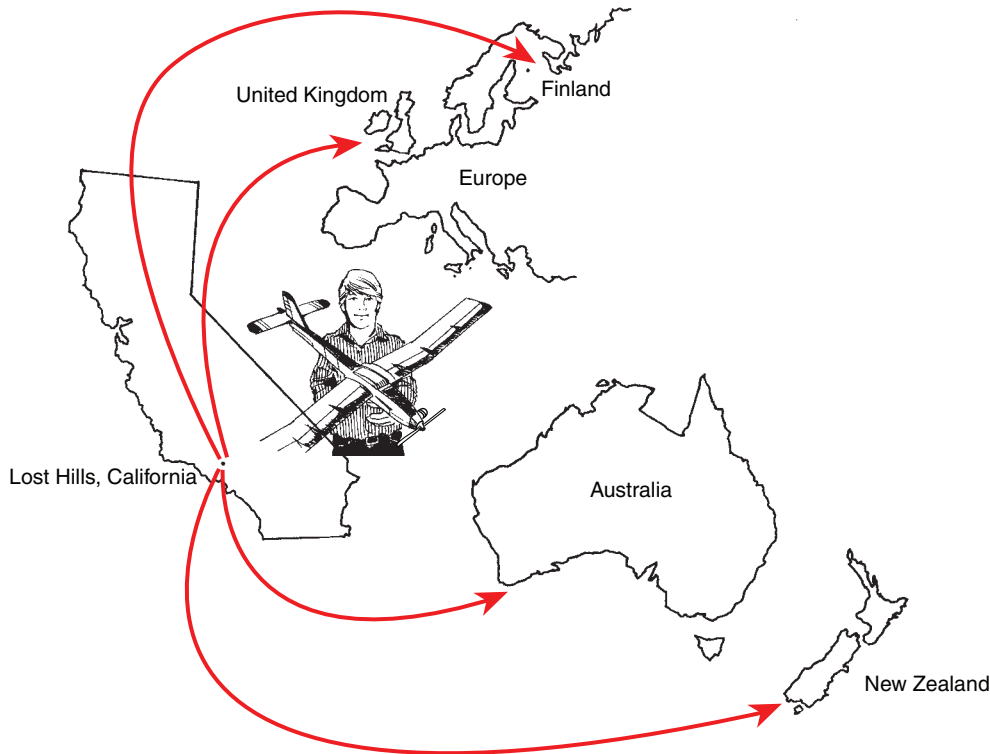


Illustration by John M. Evans

Figure 4.6 International cases of coccidioidomycosis acquired during a World Championship Model Airplane Flying competition.³⁶

immigration are major factors in the global dispersal of infectious diseases.¹⁵

Increases in travel-associated fungal infections have resulted in histoplasmosis and coccidioidomycosis recently being included as travel-related illnesses in the CDC's Yellow Book "Health Information for International Travel, 2003–2004" (<http://www.cdc.gov/travel/yb/index.htm>). Fungal infections are a cause of disease for visitors to the USA, as well as for travelers from the USA (Fig. 4.6). Mycotic infections of travelers who reside in places far from endemic areas for mycoses are presenting increasing diagnostic challenges for health-care providers, especially for diseases such as paracoccidioidomycosis (*Paracoccidioides brasiliensis*), for which symptomatic disease may not develop for years after a person resided in an endemic area.¹⁶

Travel and wilderness medicine are now specialties in their own right, with pre-travel counseling that minimizes risks and improves protection from disease, post-travel recognition of diseases that travelers may encounter,¹³ and accurate and timely diagnoses and notifications of disease events.^{17,18} Vari-

ous publications, Web sites, and other information sources provide detailed information on disease risks, prevention, control, and treatment useful for travelers and health-care providers alike (Table 4.3). Each year, efforts in these medical specialty areas expand, the public demands updated information, and medical professionals must provide adequate explanations to patients on how to avoid risks relative to infectious disease. Only through such efforts will we be able to minimize the impacts of zoonotic diseases on individuals and the potential spread of zoonoses to new locales. Such efforts will, in the long term, improve human health, decrease impacts on domestic and wild animal populations, and reduce economic hardships to local and regional economies where outbreaks could occur. Disease prevention, control, and early intervention are important factors for sustaining the health and well-being of all living creatures (Box 4–1).

James W. Hurley and Milton Friend

Literature Cited

1. Wilson, M.E., 2003, The traveler and emerging infections: sentinel, courier, transmitter: *Journal of Applied Microbiology Symposium Supplement*, v. 94, p. 1S–11S.
2. Moore, D.A.J., McCroddan, J., Dekumyoy, P., and Chiodini, P.L., 2003, Gnathostomiasis: an emerging imported disease: *Emerging Infectious Diseases*, v. 9, p. 647–650.
3. Sejvar, J. Bancroft, E., Winthrop, K., Bettinger, J., Bajani, M., Bragg, S., Shutt, K., Kaiser, R., Marano, N., Popovic, T., Tappero, J., Ashford, D., Mascola, L., Vugia, D., Perkins, B., Rosenstein, N., and the Eco-Challenge Investigation Team, 2003, Leptospirosis in “eco-challenge” athletes, Malaysian Borneo, 2000: *Emerging Infectious Diseases*, v. 9, p. 702–707.
4. Weber, D.J., and Hansen, A.R., 1991, Infections resulting from animal bites: *Infectious Disease Clinics of North America*, v. 5, p. 663–680.
5. Badilla, X., Pérez-Herra, V., Quirós, L., Morice, A., Jiménez, E., Sáenz, E., Salazar, F., Fernández, R., Orciari, L., Yager, P., Whitfield, S., and Rupprecht, C.E., 2003, Human rabies: a reemerging disease in Costa Rica?: *Emerging Infectious Diseases*, v. 9, p. 721–723.
6. Greene, C.E., and Krause, D.C., 2000, Bartonellosis, *in* Brown, C., and Bolin, C., eds., *Emerging Diseases of Animals: Washington, D.C., ASM Press*, p. 245–258.
7. Centers for Disease Control and Prevention, 1997, Outbreak of leptospirosis among white-water rafters—Costa Rica, 1996: *Morbidity and Mortality Weekly Report*, v. 46, p. 577–579.
8. Katz, A., Sasaki, D., and Mumm, A., 1997, Leptospirosis on Oahu: an outbreak among military personnel associated with recreational exposure: *Military Medicine*, v. 162, p. 101–104.
9. Centers for Disease Control and Prevention, 1998, Update: leptospirosis and unexplained acute febrile illness among athletes participating in triathlons—Illinois and Wisconsin, 1998: *Morbidity and Mortality Weekly Report*, v. 47, p. 673–676.
10. Torten, M., and Marshall, R.B., 1994, Leptospirosis, *in* Beran, G.W., Steele, J.H., Benenson, A.S., Torten, M., Dreesen, D.W., Ristic, M., and Pier, A.C., eds., *Handbook of zoonoses, section A (2nd ed.)*: Boca Raton, Fla., CRC Press, p. 245–264.
11. Krauss, H., Weber, A., Appel, M., Enders, B., Isenberg, H.D., Shiefer, H.G., Slenczka, W., von Graevenitz, A., and Zahner, H., 2003, *Zoonoses: infectious diseases transmissible from animals to humans (3rd ed.)*: Washington, D.C., ASM Press, 456 p.
12. World Tourism Organization, 2001, Tourism highlight 2001 (based on data collected through August 2001), accessed March 2, 2004, at URL <http://www.world-tourism.org>
13. Chen, L.H., 2003, Book Review: Atlas of travel medicine and health: *Emerging Infectious Diseases*, v. 9, p. 1501.
14. Satcher, D., 1994, Preface, *in* Centers for Disease Control and Prevention, *Addressing emerging infectious disease threats: a prevention strategy for the United States*: Atlanta, Ga., U.S. Department of Health and Human Services, Public Health Service, p. v (http://www.cdc.gov/ncidod/publications/eid_plan/default.htm)
15. Wilson, M.E., 1995, Travel and the emergence of infectious diseases: *Emerging Infectious Diseases*, v. 1, p. 39–46.
16. Hajjeh, R.A., and Warnock, D.W., 2004, Travel-associated fungal infections, *in* Scheld, W.M., Murray, B.E., and Hughes, J.M., eds., *Emerging Infections 6*: Washington, D.C., ASM Press, p. 133–142.
17. Centers for Disease Control and Prevention, 2004, National Center for Infectious Diseases: travelers’ health, accessed March 2, 2004, at URL <http://www.cdc.gov/travel/>
18. Dawood, R., ed., 2002, *Travellers’ health: how to stay healthy abroad (4th ed.)*: Oxford, U.K., Oxford University Press, 762 p.
19. Dean, D.J., Gordon, M.A., Severinghaus, C.W., Kroll, E.T., and Reilly, J.R., 1961, Streptothricosis: a new zoonotic disease: *New York State Journal of Medicine*, v. 61, p. 1283–1287.
20. Wobeser, G., and Brand, C.J., 1982, Chlamydiosis in two biologists investigating disease occurrences in wild waterfowl: *Wildlife Society Bulletin*, v. 10, p. 170–172.
21. Suer, L.D., and Vedros, N.A., 1988, *Erysipelothrix rhusiopathiae* I. Isolation and characterization from pinnipeds and bite abrasion wounds in humans: *Diseases of Aquatic Organisms*, v. 5, p. 1–5.
22. Centers for Disease Control and Prevention, 1995, Reptile-associated salmonellosis—selected states, 1994–1995: *Morbidity and Mortality Weekly Report*, v. 44, p. 347–350.
23. Centers for Disease Control and Prevention, 1999, Reptile-associated salmonellosis—selected states, 1996–1998: *Morbidity and Mortality Weekly Report*, v. 48, p. 1009–1013.
24. Burnham, B.R., Atchley, D.H., DeFusco, R.P., Ferris, K.E., Zicarelli, J.C., Lee, J.H., and Angulo, F.J., 1998, Prevalence of fecal shedding of *Salmonella* organisms among captive green iguanas and potential public health implications: *Journal of the American Veterinary Medical Association*, v. 213, p. 48–50.
25. Vedros, N.A., Chow, D., and Liang, E., 1988, Experimental vaccine against *Pseudomonas pseudomallei* infections in captive cetaceans: *Diseases of Aquatic Organisms*, v. 5, p. 157–161.
26. Centers for Disease Control and Prevention, 2003, Update: multistate outbreak of monkeypox—Illinois, Indiana, Kansas, Missouri, Ohio, and Wisconsin, 2003: *Morbidity and Mortality Weekly Report*, v. 52, p. 642–646.
27. Mahy, B.W.J., and Brown, C.C., 2000, Emerging zoonoses: crossing the species barrier: *Revue Scientifique et Technique, Office International des Epizooties*, v. 19, p. 33–40.
28. Gao, F., Bailes, E., Robertson, D.L., Chen, Y., Rodenburg, C.M., Michael, S.F., Cummins, L.B., Arthur, L.O., Peeters, M., Shaw, G.M., Sharp, P.M., and Hahn, B.H., 1999, Origin of HIV-1 in the chimpanzee *Pan troglodytes troglodytes*: *Nature*, v. 397, p. 436–441.
29. Hahn, B.H., Shaw, G.M., De Cock, K.H., and Sharp, P.M., 2000, AIDS as a zoonosis: scientific and public health implications: *Science*, v. 286, p. 607–619.
30. Bailes, E., Gao, F., Bibollet-Ruche, F., Courgnaud, V., Peeters, M., Marx, P.A., Hahn, B.H., and Sharp, P.M., 2003, Hybrid origin of SIV in chimpanzees: *Science*, v. 300, p. 1713.

31. Chiodini, J., and Boyne, L., 2002, *Atlas of travel medicine and health*: Hamilton, Ontario, Canada, BC Decker, 160 p.
32. National Intelligence Council, 2003, SARS: down but still a threat: National Intelligence Council, ICA 2003–09 (<http://www.fas.org/irp/nic/sars.pdf>)
33. Torten, M., 1979, Leptospirosis, *in* Steele, J.H., Stoenner, H., Kaplan, W., and Torten, M., eds., *CRC Handbook series in zoonoses, section A*: Boca Raton, Fla., CRC Press, p. 363–421.
34. Leighton, F.A., and Kuiken, T., 2001, Leptospirosis, *in* Williams, E.S., and Barker, I.K., eds., *Infectious Diseases of wild mammals*, (3rd ed.): Ames, Iowa, Iowa State University Press, p. 498–502.
35. Bolin, C., 2000, Leptospirosis, *in* Brown, C. and Bolin, C., eds., *Emerging diseases of animals*: Washington, D.C., ASM Press, p. 185–200.
36. Centers for Disease Control and Prevention, 2001, Coccidioidomycosis among persons attending the world championship of model airplane flying, Kern County, California, October 2001: *Morbidity and Mortality Weekly Report*, v. 50, p. 1106–1107.

