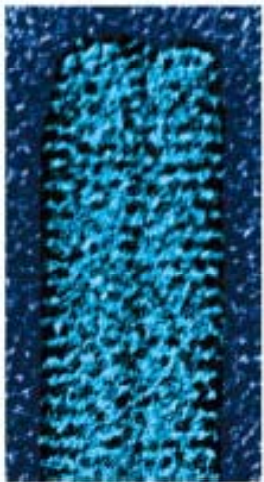
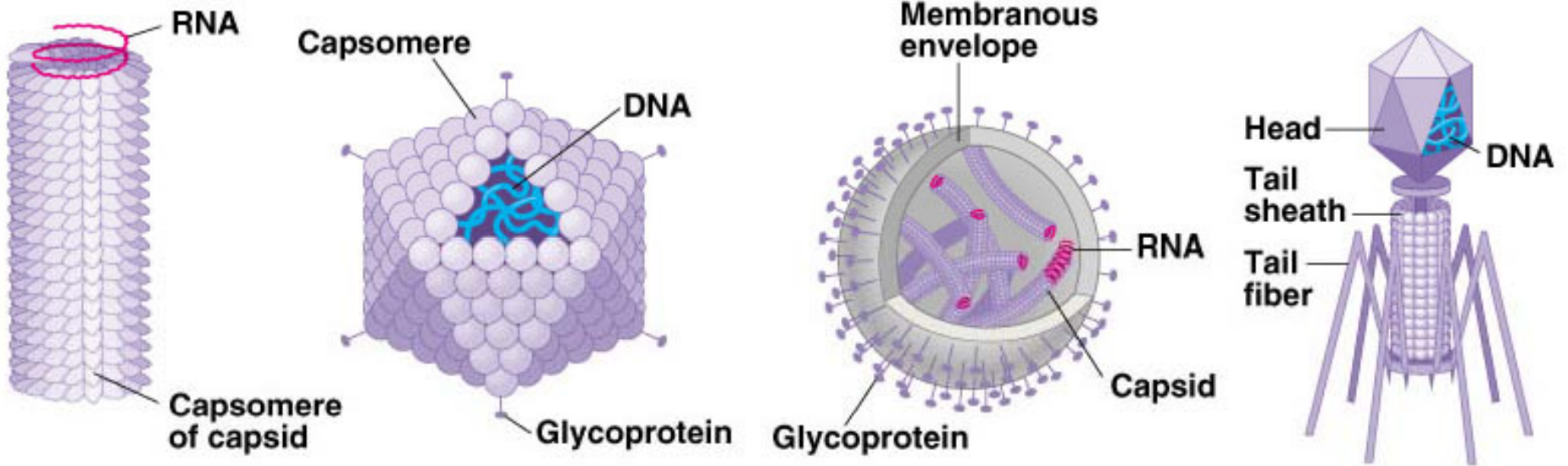
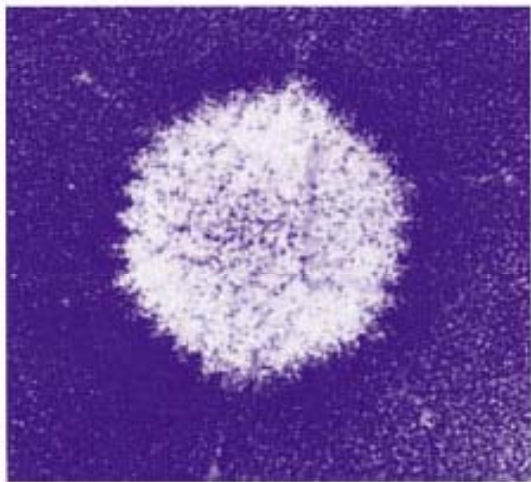


Viral structures



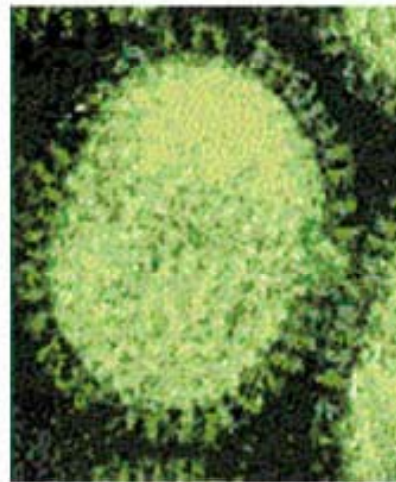
10 nm

(a) Tobacco mosaic virus



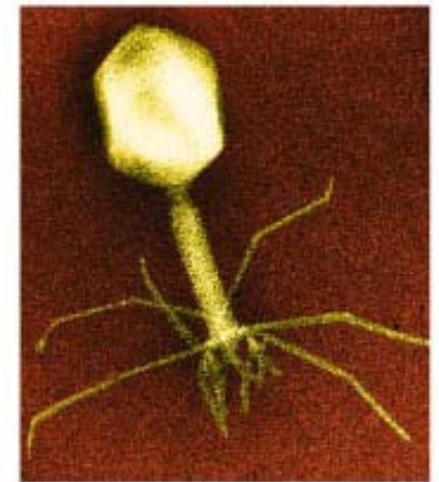
50 nm

(b) Adenoviruses



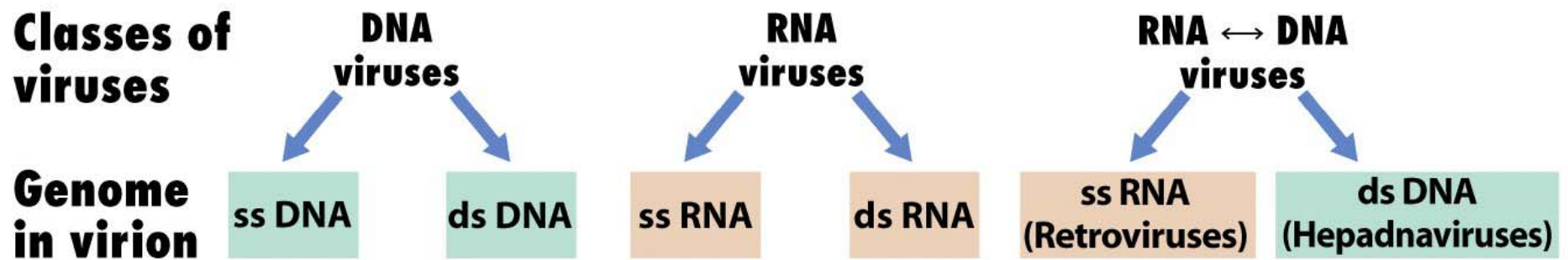
50 nm

(c) Influenza viruses



50 nm

(d) Bacteriophage T4



Viral genomes. The genomes of viruses can be composed of either DNA or RNA, and some use both as their genomic material at different stages in their life cycle. However, only **one** type of nucleic acid is found in the virion of any particular type of virus.

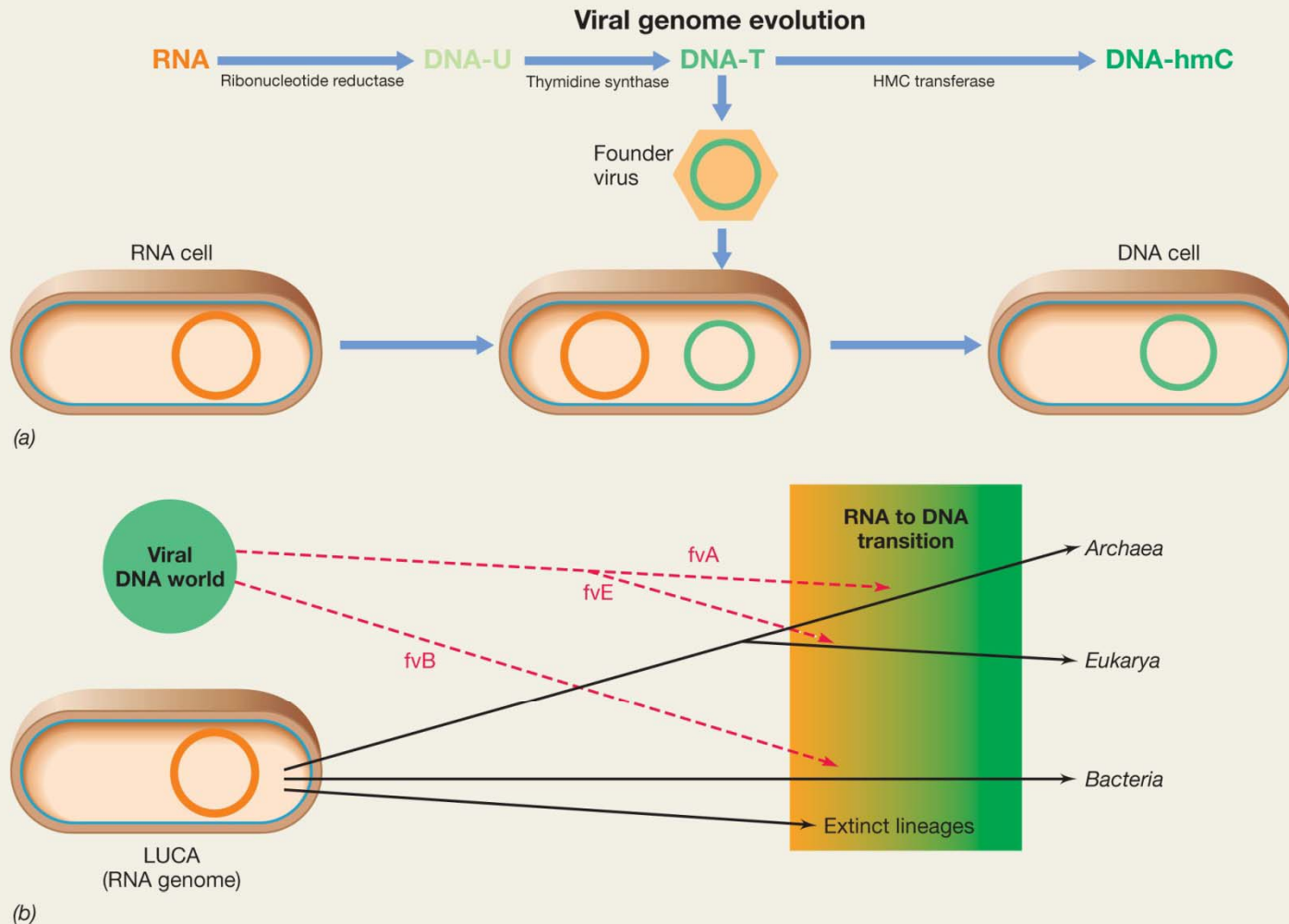
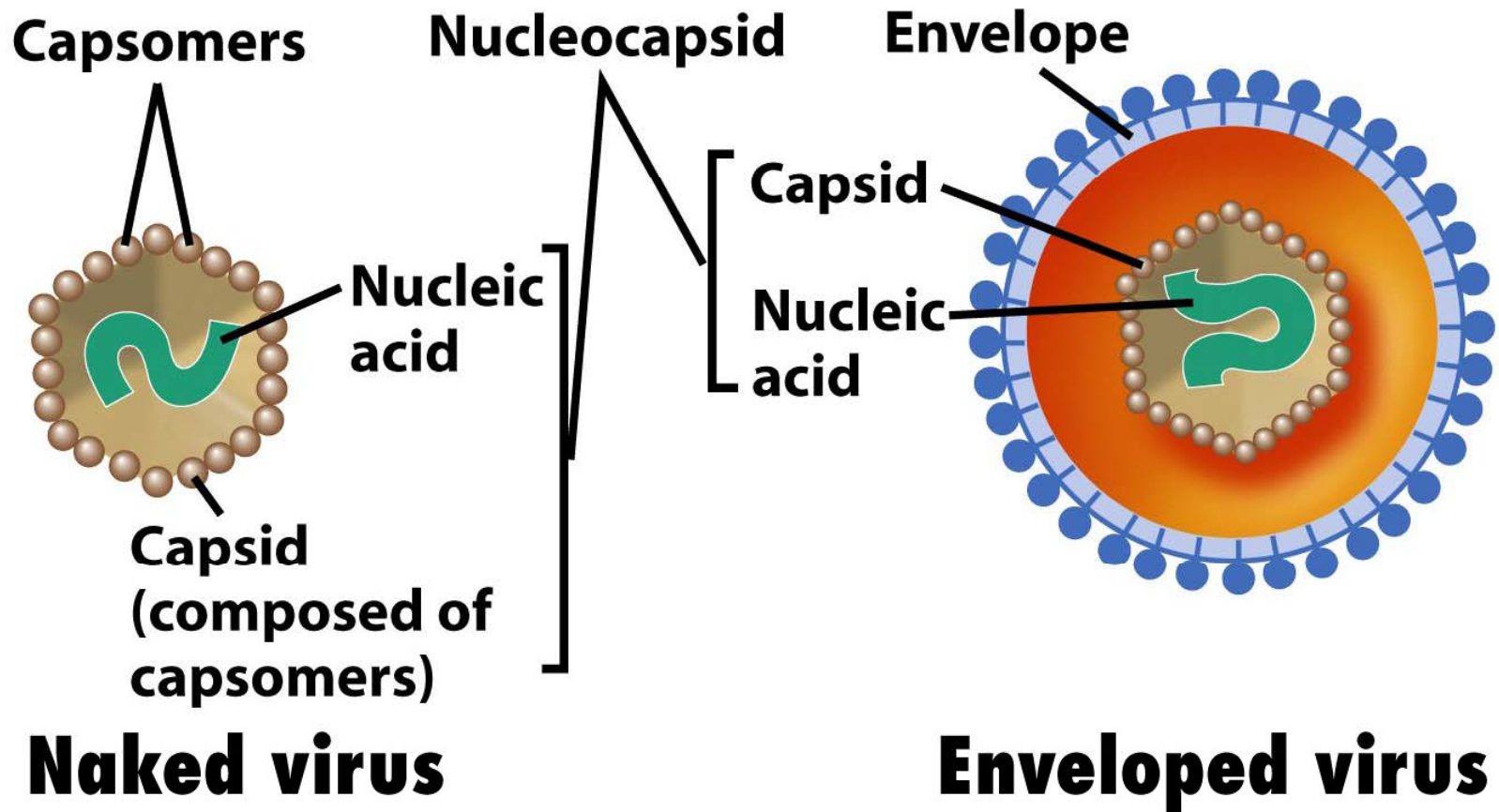


Figure 1 Hypothesis of viral origin of DNA. (a) Several successive cycles of mutation and selection resulted in the appearance of viral nucleic acids more resistant to degradation by the host cell: DNA-U, DNA with uracil; DNA-T, DNA with thymine (i.e., normal DNA); DNA-hmC, DNA with 5-hydroxymethylcytosine. All four types of nucleic acid are found in present-day viruses, although DNA-U and DNA-hmC are rare. Conversion of RNA cellular genomes to DNA postulates lysogeny by a DNA “founder virus” followed by movement of host genes onto the DNA genome. (b) Three founder viruses, fvB, fvA, fvE, are hypothesized to have infected the ancestors of the *Bacteria*, *Archaea*, and *Eukarya*, respectively. Note that viruses fvA and fvE are more closely related to each other than to fvB. As a result of viral infection, the genomes of these three ancestral lines were eventually converted from RNA to DNA. Presumably, other cellular lineages derived from the last universal common ancestor (LUCA) that retained RNA genomes are extinct.

Comparison of naked and enveloped virus, two basic types of virus particles.



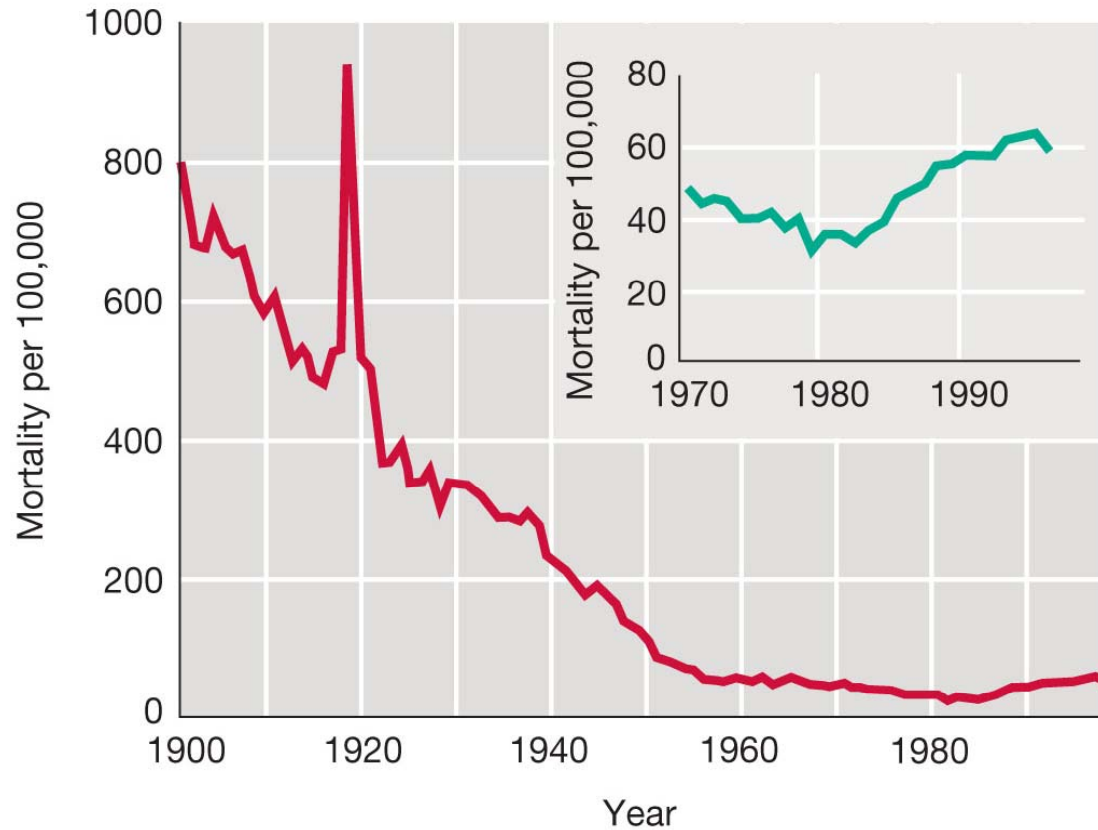


Figure 32.1 Deaths due to infectious disease in the United States.

Although infectious disease death rates steadily declined throughout most of the twentieth century (except for the large numbers of deaths in 1918–1919 caused by the influenza pandemic), the death rate has increased significantly since 1980. Adapted from Hughes, J.M. 2001. Emerging Infectious Diseases: A CDC Perspective. *Emerg. Infect. Dis.* 17: 494–496.

Table 32.1 Worldwide deaths due to infectious diseases, 2004^a

Disease	Deaths	Causative agent(s)
Respiratory infections ^b	4,259,000	Bacteria, viruses, fungi
Acquired immunodeficiency syndrome (AIDS)	2,040,000	Virus
Diarrheal diseases	2,163,000	Bacteria, viruses
Tuberculosis ^c	1,464,000	Bacterium
Malaria	889,000	Protist
Measles ^c	424,000	Virus
Meningitis, bacterial ^c	340,000	Bacterium
Pertussis (whooping cough) ^c	254,000	Bacterium
Tetanus ^c	163,000	Bacterium
Hepatitis (all types) ^d	159,000	Viruses
Syphilis	99,000	Bacterium
Trypanosomiasis (sleeping sickness)	52,000	Protist
Leishmaniasis	47,000	Protist
Schistosomiasis	41,000	Helminth
Dengue	18,000	Virus
Chagas' disease	11,000	Helminth
Japanese encephalitis	11,000	Virus
Chlamydia	9,000	Bacterium
Intestinal nematode infections	6,000	Helminth
Other communicable diseases	1,351,000	Various agents

^aGlobally, there were about 58.7 million deaths from all causes in 2004. About 13.8 million deaths, or 23.5%, were from communicable infectious diseases, nearly all in developing countries. Data show the 20 leading causes of death due to infectious diseases. The world population in 2004 was estimated at 6.4 billion. Data are from the World Health Organization (WHO), Geneva, Switzerland.

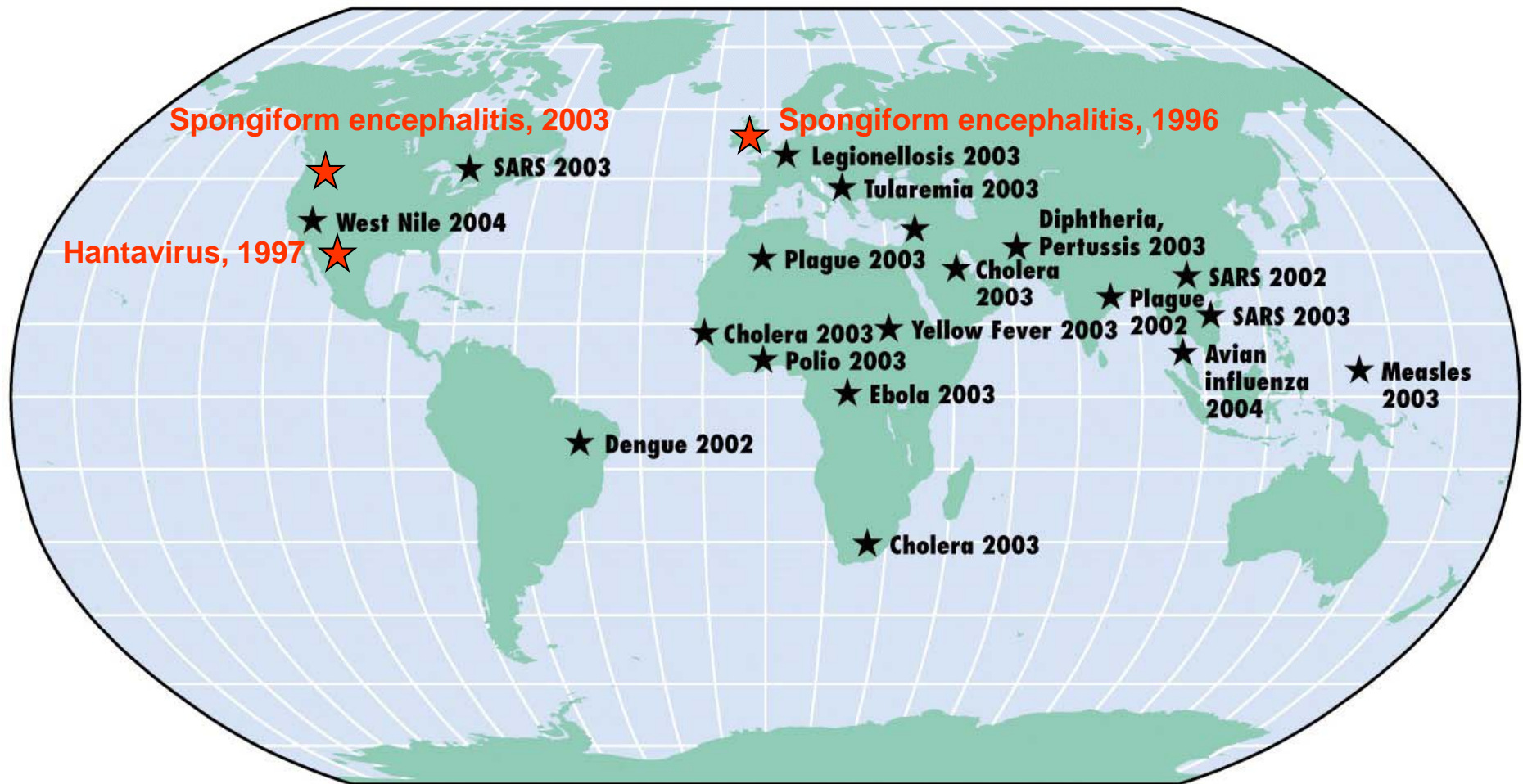
^bFor some acute respiratory agents such as influenza and *Streptococcus pneumoniae* there are effective vaccines; for others, such as colds, there are no vaccines.

^cDiseases for which effective vaccines are available.

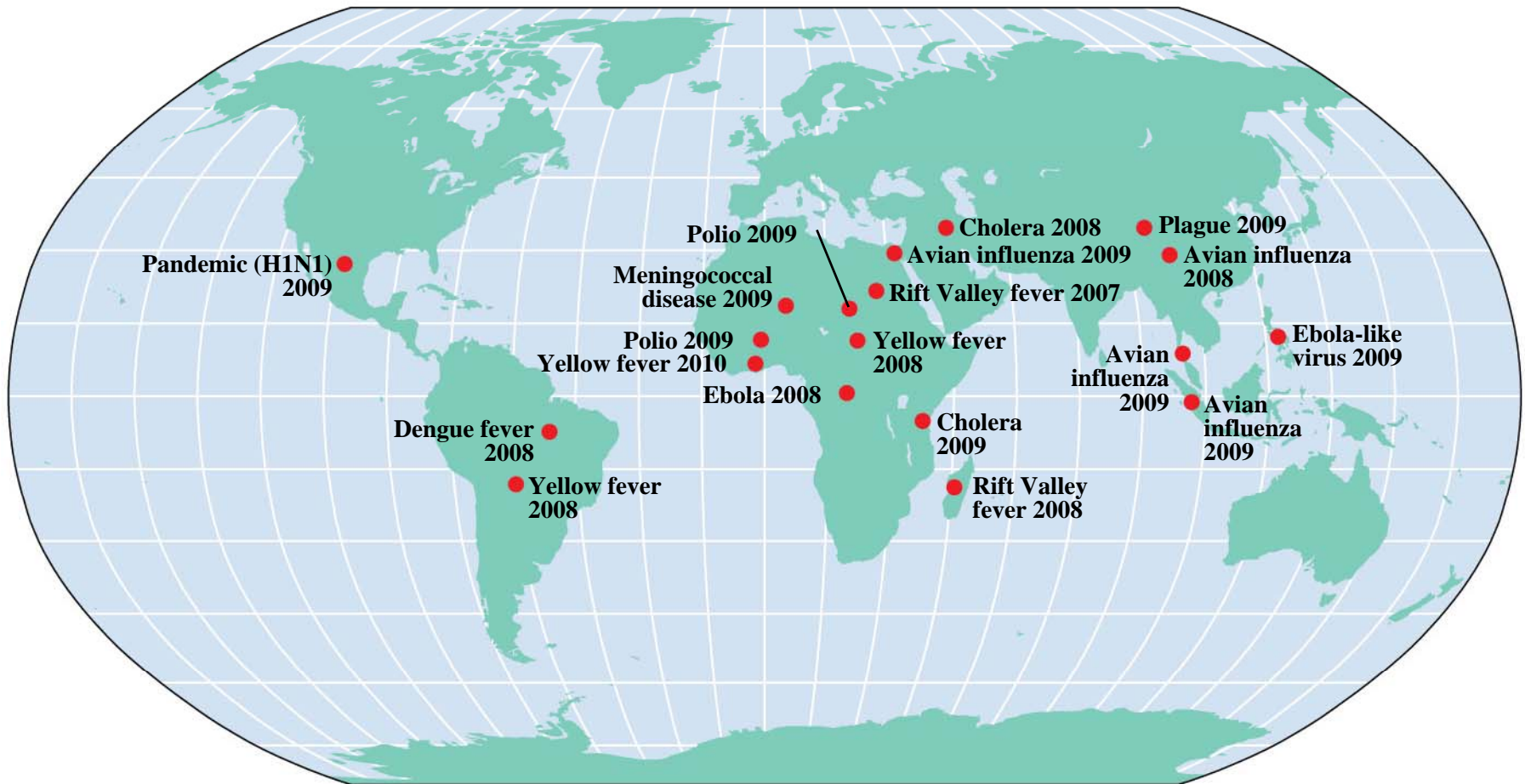
^dVaccines are available for hepatitis A virus and hepatitis B virus. There are no vaccines for other hepatitis agents.

Here ~10% infectious disease
Developing (poor) countries >50%

Recent outbreaks of emerging and reemerging infectious diseases.



More recent outbreaks of emerging and reemerging infectious diseases.





Reservoir for:
Rabies: Rhabdovirus
Rabies-like: Lyssavirus
Ebola: Filovirus
Hendra: Henipavirus
SARS: Coronaviruses

A quarter of all mammals are bats!

Zoonosis -
Infectious disease
to humans ~60%

