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CHAPTER 2

Basic Concepts of Infectious Disease

LEARNING OBJECTIVES

2.1 Normal Microbiota versus Pathogens

- 2.1a Describe differences between microbiota and pathogens.
- 2.1b Discuss the relationship between infection and disease and between virulence and pathogenicity.
- 2.1c Differentiate between infectious dose and lethal dose.
- 2.1d Discuss the fundamental attributes of a successful pathogen.

2.2 Basic Concepts of Disease

- 2.2a Distinguish between the signs and symptoms of a disease.
- 2.2b Explain the role of immunopathogenesis in infectious disease.
- 2.2c Describe the five basic stages of an infectious disease.

2.3 Infection Cycles and Disease Transmission

- 2.3a Describe complex versus simple infection cycles.
- 2.3b Differentiate endemic, epidemic, and pandemic disease.
- 2.3c Explain animal reservoirs and incubators.

2.4 Portals of Entry and Exit

- 2.4a Describe the various portals of entry and exit for microbial pathogens.
- 2.4b Discuss concepts of biosafety and biocontainment.

2.5 Host Factors in Disease

- 2.5a Define the biological features of human hosts that influence the course of an infection.
- 2.5b Explain how host behavior can impact susceptibility to disease.

2.6 Global Change and Emerging Infectious Diseases

- 2.6a Explain how efforts to expand civilization impact emerging infectious diseases.
- 2.6b Explain how climate change can alter infectious disease patterns.

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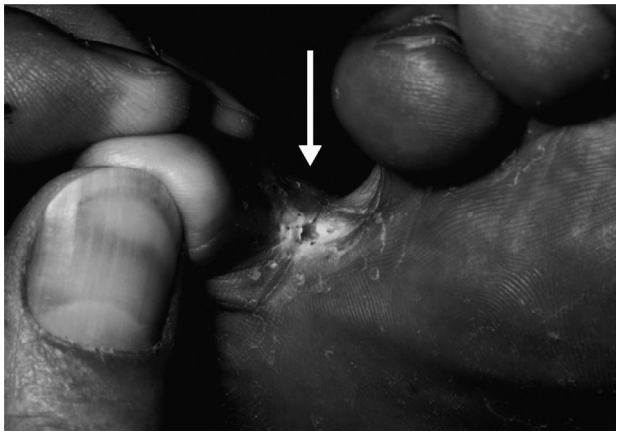
Chapter 02: Basic Concepts of Infectious Disease

MULTIPLE CHOICE

1. What kind of relationship exists between microbiota and their human hosts?
   a. mutualistic
   b. pathogenic
   c. endoparasitic
   d. ectoparasitic

   ANS: A DIF: Easy REF: 2.1
   OBJ: 2.1a Describe differences between microbiota and pathogens.
   MSC: Remembering

2. This image below shows a person afflicted with athlete's foot, which is caused by the fungus *Trichophyton rubrum*. *T. rubrum* is an example of a(n)

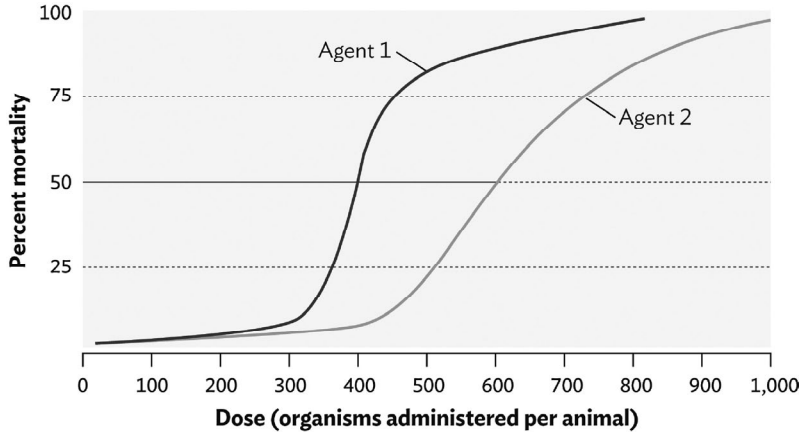


   a. endoparasite.
   b. ectoparasite.
   c. mutualist.
   d. fomite.

   ANS: B DIF: Moderate REF: 2.1
   OBJ: 2.1a Describe differences between microbiota and pathogens.
   MSC: Applying

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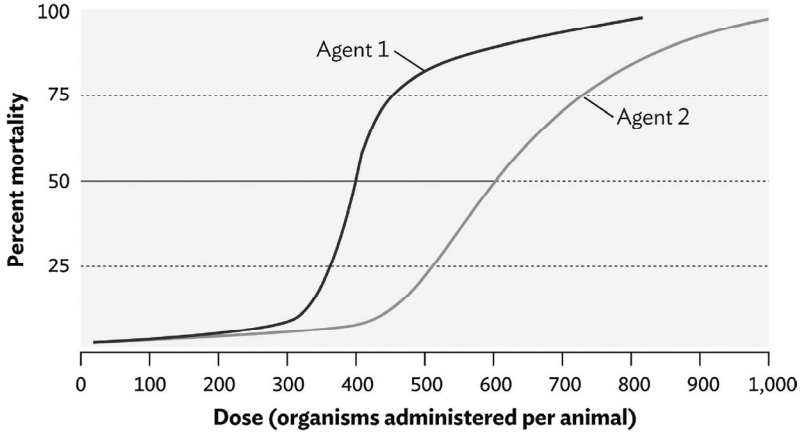
3. The graph below shows the percent mortality in populations of lab animals exposed to increasing concentrations of two different pathogens (agent 1 and agent 2). What is the lethal dose 50% (LD_{50}) of agent 2?



a. 400
b. 600
c. 800
d. 1,000

ANS: B DIF: Moderate REF: 2.1
OBJ: 2.1c Differentiate between infectious dose and lethal dose.
MSC: Understanding

4. The graph below shows the percent mortality in populations of lab animals exposed to increasing concentrations of two different pathogens (agent 1 and agent 2). Which of the following is a true statement?

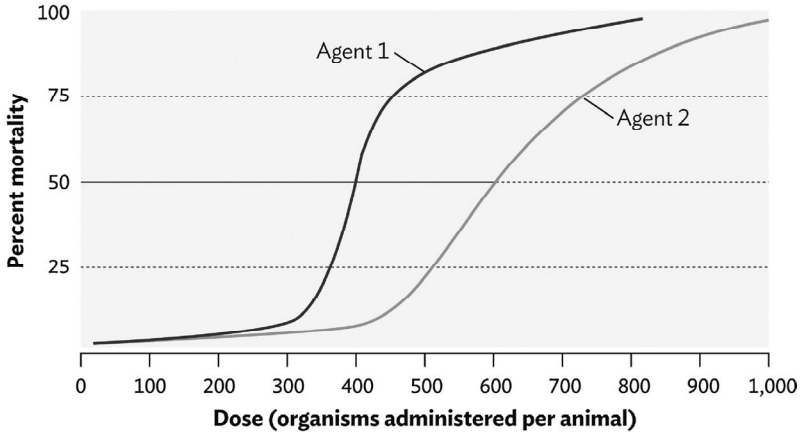


a. The LD_{50} for agent 1 is 800.
b. The LD_{50} for agent 2 is lower than that for agent 1.
c. Agent 1 is more virulent than agent 2.
d. Agent 2 is more virulent than agent 1.

ANS: C DIF: Moderate REF: 2.1
OBJ: 2.1c Differentiate between infectious dose and lethal dose.
MSC: Understanding

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5. The graph below shows the percent mortality in populations of lab animals exposed to increasing concentrations of two different pathogens (agent 1 and agent 2). Which of the following is a true statement about the LD_{50}?



a. The LD_{50} is the number of organisms required to kill 50% of the group.
b. The LD_{50} is the number of organisms required to infect 50% of the group.
c. The higher the LD_{50} the more virulent the organism.
d. The LD_{50} is the same as the ID_{50}.

ANS: A DIF: Moderate REF: 2.1
OBJ: 2.1c Differentiate between infectious dose and lethal dose.
MSC: Understanding

6. Which of the following is NOT a fundamental attribute of a successful pathogen?
a. host attachment
b. immune avoidance
c. nutrient acquisition
d. wide host range

ANS: D DIF: Moderate REF: 2.1
OBJ: 2.1d Discuss the fundamental attributes of a successful pathogen.
MSC: Understanding

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7. The image below shows a rash associated with Rocky Mountain spotted fever. This rash is an example of a



a. sign.
b. symptom.
c. sequelae.
d. fomite.

ANS: A DIF: Moderate REF: 2.2
OBJ: 2.2a Distinguish between the signs and symptoms of a disease.
MSC: Understanding

8. A fever is an example of a
a. symptom.
b. sign.
c. sequelae.
d. syndrome.

ANS: B DIF: Moderate REF: 2.2
OBJ: 2.2a Distinguish between the signs and symptoms of a disease.
MSC: Understanding

9. Colonization occurs during the _____ phase of an infectious disease.
a. incubation
b. illness
c. decline
d. prodromal

ANS: A DIF: Moderate REF: 2.2
OBJ: 2.2c Describe the five basic stages of an infectious disease.
MSC: Applying

10. Which of the following is an example of a symptom?
a. a rash
b. swollen glands
c. jaundice (yellow tinge to the skin)
d. muscle aches

ANS: D DIF: Moderate REF: 2.2
OBJ: 2.2a Distinguish between the signs and symptoms of a disease.
MSC: Applying

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11. A mosquito can transmit a viral pathogen into humans. The mosquito is an example of a(n)
    a. fomite.
    b. symptom.
    c. vector.
    d. endoparasite.

    ANS: C DIF: Easy REF: 2.3
    OBJ: 2.3a Describe complex versus simple infection cycles. MSC: Remembering

12. An island nation normally has low background level of cholera. After an earthquake, sanitation is disrupted and cholera cases spike to high levels on the island but not in other areas of the world. The spike in cholera cases is an example of a(n)
    a. endemic disease.
    b. epidemic disease.
    c. pandemic disease.
    d. opportunistic infection.

    ANS: B DIF: Easy REF: 2.3
    OBJ: 2.3b Differentiate endemic, epidemic, and pandemic disease.
    MSC: Understanding

13. Human immunodeficiency virus (HIV) spreads directly from person to person via intimate contact. HIV exhibits
    a. a simple infection cycle.
    b. a complex infection cycle.
    c. vehicle transmission.
    d. indirect transmission.

    ANS: A DIF: Easy REF: 2.3
    OBJ: 2.3a Describe complex versus simple infection cycles. MSC: Understanding

14. Lily (who has lice) brings a comb to school for picture day. After Lily combs her hair, Leticia asks to borrow the comb. Leticia later is diagnosed with lice. In this example, the comb is a(n)
    a. carrier.
    b. fomite.
    c. incubator.
    d. portal.

    ANS: B DIF: Moderate REF: 2.3
    OBJ: 2.3a Describe complex versus simple infection cycles. MSC: Understanding

15. Adhesins are proteins on the surface of microbes. Adhesins help most with which fundamental pathogen attribute?
    a. host attachment
    b. immune avoidance
    c. nutrient acquisition
    d. host mortality

    ANS: A DIF: Moderate REF: 2.1
    OBJ: 2.1d Discuss the fundamental attributes of a successful pathogen.
    MSC: Understanding

16. The acme of an infectious disease, when the symptoms are most severe, occurs during which phase of the infection?
    a. incubation
    b. illness
    c. decline
    d. prodromal

    ANS: B DIF: Moderate REF: 2.2
    OBJ: 2.2c Describe the five basic stages of an infectious disease.
    MSC: Remembering

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17. During which phase of an infectious disease do disease symptoms begin to subside?
    a. incubation
    b. prodromal
    c. decline
    d. convalescent

    ANS: C DIF: Easy REF: 2.2
    OBJ: 2.2c Describe the five basic stages of an infectious disease.
    MSC: Remembering

18. What factor favors an infectious disease to become pandemic instead of epidemic?
    a. a localized animal reservoir
    b. rapid mortality
    c. a low infectious dose 50%
    d. a long incubation period

    ANS: C DIF: Difficult REF: 2.3
    OBJ: 2.3b Differentiate endemic, epidemic, and pandemic disease.
    MSC: Evaluating

19. Walter defecates in the company restroom, does not wash his hands thoroughly, and then uses the office coffeepot, transferring bacteria onto the handle of the pot. Marcia pours some coffee and then goes to her desk to eat a muffin, ingesting some of the bacteria she picked up from the coffeepot. What is the route of transmission of this infection?
    a. fecal-oral
    b. respiratory
    c. urogenital
    d. parenteral

    ANS: A DIF: Easy REF: 2.4
    OBJ: 2.4a Describe the various portals of entry and exit for microbial pathogens.
    MSC: Understanding

20. A mosquito can transmit a viral pathogen into humans. What is the mode of transmission of the virus in this instance?
    a. oral
    b. respiratory
    c. urogenital
    d. parenteral

    ANS: D DIF: Easy REF: 2.4
    OBJ: 2.4a Describe the various portals of entry and exit for microbial pathogens.
    MSC: Remembering

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21. The image below shows a man sneezing, leading to an aerosol of pathogens. What is the most likely mode of transmission of these pathogens to another person?



a. fecal-oral
b. respiratory
c. urogenital
d. parenteral

ANS: B DIF: Easy REF: 2.4
OBJ: 2.4a Describe the various portals of entry and exit for microbial pathogens.
MSC: Understanding

22. Which of the following might be an effective means of limiting a disease spread via a urogenital route?
a. not sharing needles
b. wearing condoms during sexual activity
c. wearing a mask that covers the nose and mouth
d. washing hands before eating

ANS: B DIF: Moderate REF: 2.4
OBJ: 2.4a Describe the various portals of entry and exit for microbial pathogens.
MSC: Applying

23. Which of the following is the most effective means of limiting a disease spread via a parenteral route?
a. not sharing needles
b. wearing condoms during sexual activity
c. wearing a mask that covers the nose and mouth
d. cooking foods thoroughly

ANS: A DIF: Moderate REF: 2.4
OBJ: 2.4a Describe the various portals of entry and exit for microbial pathogens.
MSC: Applying

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24. Which of the following might be an effective means of limiting a disease spread via an oral route?
    a. not sharing needles
    b. wearing condoms during sexual activity
    c. checking for and removing ticks after outdoor activity
    d. washing hands before eating

    ANS: D DIF: Easy REF: 2.4
    OBJ: 2.4a Describe the various portals of entry and exit for microbial pathogens.
    MSC: Applying

25. The most dangerous potential bioterrorism agents have what portal of entry into the human body?
    a. respiratory
    b. urogenital
    c. parenteral
    d. fecal

    ANS: A DIF: Easy REF: 2.4
    OBJ: 2.4b Discuss concepts of biosafety and biocontainment. MSC: Applying

26. The image below shows a researcher working in a positive-pressure suit. Such attire is required to work with biological agents in which risk level?



    a. risk group I
    b. risk group II
    c. risk group III
    d. risk group IV

    ANS: D DIF: Easy REF: 2.4
    OBJ: 2.4b Discuss concepts of biosafety and biocontainment. MSC: Remembering

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27. *Giardia lamblia*, a cause of diarrhea and other gastrointestinal symptoms, is acquired from contaminated drinking water. It can be treated with several different antimicrobial drugs. Into what risk level does *G. lamblia* fall?
    a. risk group I
    b. risk group II
    c. risk group III
    d. risk group IV

    ANS: B DIF: Moderate REF: 2.4
    OBJ: 2.4b Discuss concepts of biosafety and biocontainment. MSC: Evaluating

28. What factor is most responsible for both the very young and the very old being most susceptible to infectious diseases?
    a. the host genotype
    b. different portals of entry for pathogens
    c. the host immune system
    d. the inability of these populations to communicate symptoms to health care providers

    ANS: C DIF: Moderate REF: 2.5
    OBJ: 2.5b Explain how host behavior can impact susceptibility to disease.
    MSC: Remembering

29. The host immune response can be weakened by
    a. too little sleep.
    b. moderate exercise.
    c. proper nutrition.
    d. avoiding alcohol and drugs.

    ANS: A DIF: Easy REF: 2.5
    OBJ: 2.5a Define the biological features of human hosts that influence the course of an infection.
    MSC: Remembering

30. Which of the following host factors can prevent disease by limiting exposure?
    a. too little sleep
    b. moderate exercise
    c. working in the health care field
    d. proper hygiene

    ANS: D DIF: Easy REF: 2.5
    OBJ: 2.5b Explain how host behavior can impact susceptibility to disease.
    MSC: Applying

31. During which phase of an infectious disease are immunopathologies most likely to first appear?
    a. incubation
    b. invasive
    c. decline
    d. convalescent

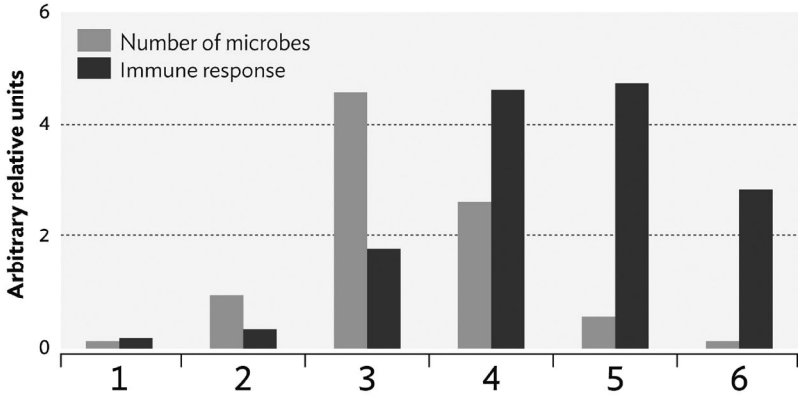
    ANS: B DIF: Moderate REF: 2.2
    OBJ: 2.2b Explain the role of immunopathogenesis in infectious disease.
    MSC: Applying

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32. Known diseases that rapidly increase in incidence and/or geographic range are known as
a. emerging.
b. reemerging.
c. zoonotic.
d. etiologic agents.

ANS: B DIF: Easy REF: 2.6
OBJ: 2.6a Explain how efforts to expand civilization impact emerging infectious diseases.
MSC: Remembering

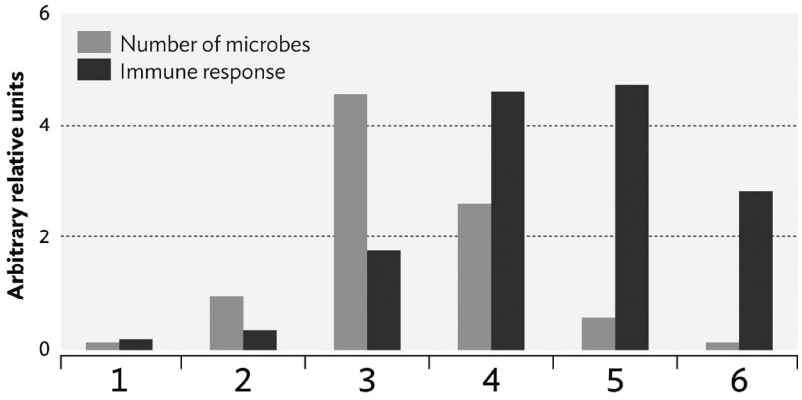
33. Which number in the graph shown below corresponds to the decline phase of an infectious disease?



a. 2
b. 3
c. 4
d. 5

ANS: C DIF: Moderate REF: 2.2
OBJ: 2.2c Describe the five basic stages of an infectious disease.
MSC: Analyzing

34. Which number in the graph shown below corresponds to the convalescence period?

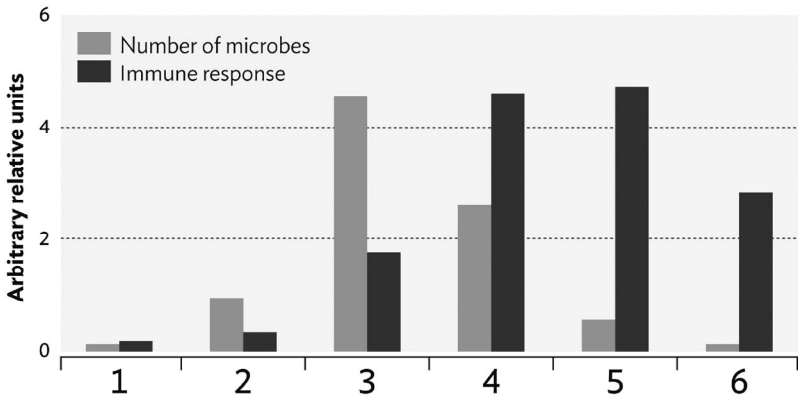


a. 1
b. 3
c. 5
d. 6

ANS: D DIF: Moderate REF: 2.2
OBJ: 2.2c Describe the five basic stages of an infectious disease.
MSC: Analyzing

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35. Which stage of an infectious disease does number 3 represent?



a. incubation phase
b. illness phase
c. prodromal phase
d. decline phase

ANS: C DIF: Moderate REF: 2.2
OBJ: 2.2c Describe the five basic stages of an infectious disease.
MSC: Analyzing

36. Infectious dose is measured by determining how many microbes are required to cause
a. disease symptoms in half of an experimental group of hosts.
b. death in half of an experimental group of hosts.
c. disease symptoms in all of an experimental group of hosts.
d. death in all of an experimental group of hosts.

ANS: A DIF: Easy REF: 2.1
OBJ: 2.1c Differentiate between infectious dose and lethal dose.
MSC: Remembering

37. The ability of a microbe to cause disease is known as
a. emergence.
b. invasiveness.
c. pathogenicity.
d. virulence.

ANS: C DIF: Easy REF: 2.1
OBJ: 2.1c Differentiate between infectious dose and lethal dose.
MSC: Remembering

38. Most likely, pathogens with a broad host range
a. are highly virulent in all hosts.
b. are unlikely to be zoonotic diseases.
c. are less likely than narrow–host range pathogens to respond to antibiotics.
d. recognize receptors that are very similar among different hosts.

ANS: D DIF: Difficult REF: 2.1
OBJ: 2.1d Discuss the fundamental attributes of a successful pathogen.
MSC: Evaluating

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39. Which of the following statements is FALSE regarding climate change?
    a. It will not affect human disease patterns.
    b. It can alter insect vector distribution.
    c. It can foster emerging diseases.
    d. It can foster reemerging diseases.

    ANS: A DIF: Easy REF: 2.6
    OBJ: 2.6b Explain how climate change can alter infectious disease patterns.
    MSC: Remembering

40. A particular virus has a high infectious dose 50% and extremely low mortality, causing only mild symptoms. This virus has _____ infectivity and _____ virulence.
    a. high; high
    b. high; low
    c. low; low
    d. low; high

    ANS: C DIF: Difficult REF: 2.1
    OBJ: 2.1b Discuss the relationship between infection and disease and between virulence and pathogenicity. | 2.1c Differentiate between infectious dose and lethal dose.
    MSC: Analyzing

41. *Francisella tularensis* is a highly infectious bacterium that can be contracted via multiple routes including inhalation. It causes severe disease but is treatable. *F. tularensis* falls into risk group
    a. I.
    b. II.
    c. III.
    d. IV.

    ANS: C DIF: Moderate REF: 2.4
    OBJ: 2.4b Discuss concepts of biosafety and biocontainment. MSC: Evaluating

42. The main way that climate change can affect infectious disease patterns is by
    a. causing the evolution of new animal species that can serve as hosts to emerging pathogens.
    b. altering where organisms can live.
    c. increasing the virulence of pathogens.
    d. decreasing the virulence of pathogens.

    ANS: B DIF: Moderate REF: 2.6
    OBJ: 2.6b Explain how climate change can alter infectious disease patterns.
    MSC: Analyzing

43. Which of the following is NOT a driver of emerging diseases?
    a. decreased human drug use
    b. climate change
    c. microbial evolution
    d. changing land use patterns

    ANS: A DIF: Moderate REF: 2.6
    OBJ: 2.6a Explain how efforts to expand civilization impact emerging infectious diseases.
    MSC: Understanding

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44. Transplacental transmission is an example of _____ transmission.
    a. fecal-oral
    b. vehicle
    c. indirect
    d. direct

    ANS: D DIF: Moderate REF: 2.3
    OBJ: 2.3a Describe complex versus simple infection cycles. MSC: Applying

45. The difference between an emerging and a reemerging disease is that emerging diseases _____, and reemerging diseases _____.
    a. are of viral origin; are bacterial
    b. are ones for which vaccines exist; lack vaccines
    c. are new to humans; are known but are rapidly increasing in incidence and/or geographic range
    d. evolve within humans; are of zoonotic origin

    ANS: C DIF: Easy REF: 2.6
    OBJ: 2.6a Explain how efforts to expand civilization impact emerging infectious diseases.
    MSC: Remembering

46. **CASE HISTORY**

    In 1884, Yong Ding was a 38-year-old male in Canton, located in southern China. Life was hard, but Yong Ding, a cook, still managed to support his family. As he walked to his restaurant each day, he barely noticed the small bands of rats scurrying through the streets. Disease was rampant that year; victims of the Shuyi (rat epidemic) were stacked like firewood in the streets, five bodies high in places, waiting to be taken to burial. Yong knew that the disease started as a swollen gland in the armpit that often had a black appearance (now called a bubo). He checked himself daily for these swellings and, seeing none, always felt relief. Then, one morning, he found one. Within days, Yong Ding began coughing blood as the agent (a mystery at the time) spread through his bloodstream to his lungs. Once that happened, Yong Ding knew death was not far behind. More than 60,000 died this way in what was to be the start of the Third Pandemic of bubonic plague. Yong Ding's body was one of many lining the street that year.

    We now know that the cook Yong Ding was living through the Third Epidemic of bubonic plague. We also know that the rats that scurried through the streets were infested with fleas, which carried the causative agent of the bubonic plague, *Yersinia pestis*. In this complex infection cycle, which organism was the vector?
    a. *Yersinia pestis*
    b. rats
    c. fleas
    d. humans

    ANS: C DIF: Easy REF: Case History 2.2
    OBJ: 2.3c Explain animal reservoirs and incubators. MSC: Applying

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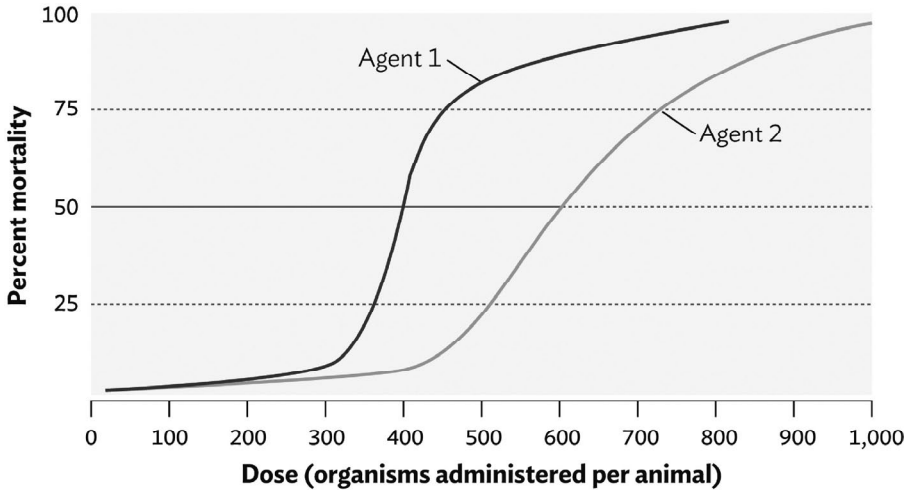
COMPLETION

1. The ability of a microbe to attach to a body surface is known as _____.

   ANS: colonization

   DIF: Moderate REF: 2.1
   OBJ: 2.1a Describe differences between microbiota and pathogens.
   MSC: Remembering

2. The graph below shows the percent mortality in populations of lab animals exposed to increasing concentrations of two different pathogens (agent 1 and agent 2). Agent _____ is more virulent.



   ANS: 1; one

   DIF: Moderate REF: 2.1
   OBJ: 2.1b Discuss the relationship between infection and disease and between virulence and pathogenicity. MSC: Evaluating

3. A fever is often a host response to a pathogen. As such, a fever is an example of a _____.

   ANS: sign

   DIF: Difficult REF: 2.2
   OBJ: 2.2b Explain the role of immunopathogenesis in infectious disease.
   MSC: Understanding

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4. The typical signs and symptoms of a disease first appear during the _____ phase of an infectious disease.

   ANS: illness

   DIF: Moderate REF: 2.2
   OBJ: 2.2c Describe the five basic stages of an infectious disease.
   MSC: Remembering

5. A disease that can spread to humans from nonhuman animals is known as a _____ disease.

   ANS: zoonotic

   DIF: Easy REF: 2.3 OBJ: 2.3c Explain animal reservoirs and incubators.
   MSC: Remembering

6. An infectious disease that rapidly increases in incidence throughout the world is known as a _____.

   ANS: pandemic

   DIF: Easy REF: 2.3
   OBJ: 2.3b Differentiate endemic, epidemic, and pandemic disease.
   MSC: Remembering

7. In some parts of the world, human immunodeficiency virus is endemic. Endemic diseases require a reservoir to serve as a source of pathogen. The reservoir for HIV is _____.

   ANS: humans

   DIF: Moderate REF: 2.3 OBJ: 2.3c Explain animal reservoirs and incubators.
   MSC: Applying

SHORT ANSWER

1. Describe the difference between an infection and a disease.

   ANS:
   An infection occurs any time a pathogen enters or starts to grow on a host. An infection does not necessarily lead to disease—a disruption of the normal structure or function of any body part, organ, or system that can be recognized by a characteristic set of symptoms and signs.

   DIF: Moderate REF: 2.1
   OBJ: 2.1b Discuss the relationship between infection and disease and between virulence and pathogenicity. MSC: Understanding

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2. Why is the lethal dose 50% easier to determine than the infectious dose 50%?

   ANS:
   The LD_{50} has a clear end point of death, so it is easy to measure. The ID_{50} is measured by determining how many microbes are required to cause disease symptoms in half of an experimental group of hosts. Disease symptoms may be hard to measure in nonverbal animals and may be more subjective.

   DIF: Difficult REF: 2.1
   OBJ: 2.1c Differentiate between infectious dose and lethal dose.
   MSC: Evaluating

3. What distinguishes simple from complex infection cycles?

   ANS:
   In a simple infection cycle the pathogen passes directly from one individual to another. In a complex infection cycle the pathogen is not transmitted via direct contact but instead is transmitted indirectly through an intermediary such as a fomite or a vector.

   DIF: Moderate REF: 2.3
   OBJ: 2.3a Describe complex versus simple infection cycles. MSC: Analyzing

4. What is the difference between a sign and a symptom?

   ANS:
   Signs (such as rashes) can be observed by others. Symptoms (body aches) cannot be directly observed by others but are felt by the patient.

   DIF: Easy REF: 2.2
   OBJ: 2.2a Distinguish between the signs and symptoms of a disease.
   MSC: Remembering

5. Why do some public health departments widely spray insecticides in the spring and summer?

   ANS:
   Because mosquitoes and other insects often serve as pathogen vectors and reservoirs, limiting insect populations can decrease human disease incidence.

   DIF: Difficult REF: 2.3 OBJ: 2.3c Explain animal reservoirs and incubators.
   MSC: Applying

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6. What is immunopathology?

   ANS:
   Immunopathology refers to disease signs and symptoms caused by the host immune system in response to the pathogen. Immunopathologies may include runny nose, fever, rash, and headache.

   DIF: Moderate REF: 2.2
   OBJ: 2.2b Explain the role of immunopathogenesis in infectious disease.
   MSC: Understanding

7. Describe how bacterial adhesins affect the preferred entry portal of pathogens.

   ANS:
   To initiate a productive infection, bacteria must attach to host cells. Attachment is mediated by bacterial adhesins binding to host receptors. Different portals of entry contain different kinds of host cells with different receptors. The adhesins may only allow attachment to cells in certain portals.

   DIF: Difficult REF: 2.4
   OBJ: 2.4a Describe the various portals of entry and exit for microbial pathogens.
   MSC: Analyzing

8. Describe how a pathogen could use an exit portal different from the portal it used to enter the host.

   ANS:
   Possible answers include the following: diarrhea-causing bacteria and viruses can enter via the oral route but leave via defecation; HIV can enter via the urogenital route and leave via the parenteral route in a needle (or vice versa—enter via a needle and exit via urogenital).

   DIF: Moderate REF: 2.4
   OBJ: 2.4a Describe the various portals of entry and exit for microbial pathogens.
   MSC: Applying

9. What distinguishes risk level III from risk level IV organisms?

   ANS:
   While both risk level III and risk level IV pathogens can lead to lethal diseases, level IV pathogens tend to be more virulent and lack treatment options.

   DIF: Moderate REF: 2.4
   OBJ: 2.4b Discuss concepts of biosafety and biocontainment. MSC: Remembering

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10. List a few host factors that can influence the course of an infection by impacting immune status.

ANS:
Host age, nutritional status, and the presence of other diseases (e.g., HIV) can all affect host immune status.

DIF: Easy REF: 2.5
OBJ: 2.5a Define the biological features of human hosts that influence the course of an infection.
MSC: Remembering

11. **CASE HISTORY**

Brandon, a 30-year-old stockbroker living in Chicago, visited his physician's office. When the nurse asked Brandon why he was there, he blushed and said he wanted to talk only to the physician about his problem. Once the doctor entered the room, Brandon explained he had a small round lesion on his penis. When asked about his sexual partners, Brandon initially said he was dating only one woman, but when pressed, he admitted he had been intimate with two women over the past month and one man. Upon examination, the lesion appeared to cause no pain but exuded a clear fluid. The physician quickly sent a sample of the fluid to the clinical laboratory. There the sample was found to contain highly motile, corkscrew-shaped bacteria. The diagnosis was syphilis, caused by the bacterium Treponema pallidum. Left untreated, the disease could eventually cause horrible disfiguration and death. Confident that he knew the cause, the physician gave Brandon a shot of long-acting penicillin.

What signs and/or symptoms of disease (distinguish between the two in your answer) did Brandon's doctor note as a part of this diagnosis?

ANS:
Signs include lesion and fluid exudate. Symptoms include painlessness of lesion.

DIF: Easy REF: Case History Chapter 2 Intro
OBJ: 2.2a Distinguish between the signs and symptoms of a disease.
MSC: Applying

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12. **CASE HISTORY**

In 2004, three people in Boston came down with a virulent form of pneumonia. An investigation by public health officials discovered that all three worked at the same laboratory studying Francisella tularensis, a bacterium that is highly infectious (although not usually spread by person-to-person contact). Under specific conditions, the organism can be aerosolized and inhaled and cause deadly pneumonia—making it a possible bioterrorism agent. Its handling is highly restricted by U.S. Homeland Security. Scientists studying this bacterium must use extreme precautionary measures to ensure that it cannot escape the laboratory. The investigation determined that the Boston researchers had indeed contracted tularemia. The scientists appear to have handled the organism in several instances without wearing or using proper protective gear—for example, examining agar plates containing the organism outside a biosafety containment hood. From the type of disease and the laboratory procedures performed, it seemed that the victims, who all fully recovered, inhaled the organism while working with it.

When working with a Risk Group III–level organism, the scientists should have known what types of precautions to take to decrease their risk of susceptibility. What protective measures should they have used to decrease their risk of susceptibility?

ANS:
Protective measures should have included a biosafety containment hood and personal protective equipment.

DIF: Moderate REF: Case History 2.3
OBJ: 2.4b Discuss concepts of biosafety and biocontainment. MSC: Applying

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