

Multiple choice. (1 point each) Choose the one best answer to each of the following questions.

1. **C** Which of the following areas of the body do not have a resident microbial flora?

- A. upper respiratory tract
- B. eyes
- C. bladder
- D. ear

2. **D** Which statement(s) is/are true?

- A. Gram positive organisms dominate the microflora.
- B. *Propionibacterium acnes* is a normal resident of the skin.
- C. Lipophilic yeasts are sometimes normal residents of the skin.
- D. All of the above

3. **D** Which of the following phenomena is/are associated with the metabolic and biochemical activities of the intestinal microflora?

- A. Vitamin synthesis
- B. Production of amines
- C. Production of organic acids
- D. All of the above.

4. **C** Which of the following organisms is most likely to be implicated in dental caries?

- A. *Staphylococcus aureus*
- B. *Staphylococcus epidermidis*
- C. *Streptococcus sobrinus*
- D. *Escherichia coli*

5. **B** Which statement is true about an exotoxin?

- A. It is mostly produced by gram negative bacteria.
- B. Its LD₅₀ may be as low as the picogram level.
- C. It is composed primarily of carbohydrate.
- D. It is LPS associated.

6. **B** Gingivitis is a(n)

- A. early form of bone loss.
- B. inflammation of the soft tissue.
- C. periodontal disease.
- D. all of the above.

7. **A** Which of the following is an enterotoxin?

- A. Cholera toxin
- B. Diphtheria toxin
- C. Plague toxin
- D. LPS of Salmonella

8. **B** Which exotoxin binds to inhibitory neurons, blocking the release of glycine, and resulting in twitching paralysis?

- A. Diphtheria toxin
- B. Tetanus toxin
- C. Botulinum toxin
- D. Cholera toxin

9. A Which of the following is/are associated with bacterial invasion?

- A. Collagenase
- B. Phospholipase
- C. Hemolysin
- D. All of the above

10. D The toxin of *Clostridium tetani* is classified as a(n)

- A. Endotoxin
- B. Cytotoxin
- C. Enterotoxin
- D. Neurotoxin

11. B The substance in the LPS for gram negative bacteria that is responsible for the effects of the toxin is

- A. The core polysaccharide
- B. Lipid A
- C. The O-polysaccharide
- D. the dideoxysugars

12. A Antibacterial substances found in the mouth include

- A. Lysozyme
- B. Lysozome
- C. Lipase
- D. All of the above

13. A Hemolysins are lytic agents that

- A. lyse red blood cells
- B. lyse white blood cells
- C. lyse bacterial cells
- D. destroy viruses

14. A Which of the following virulence factors are important for pathogenicity in *Streptococcus pneumoniae*?

- A. capsule
- B. exotoxin P
- C. hemolysin
- D. all of the above

15. C The most common of all nosocomial infections are found in the

- A. blood
- B. reproductive tract
- C. urinary tract
- D. respiratory tract

16. C MacConkey's agar and EMB agar are

- A. selective but not differential
- B. differential but not selective
- C. both selective and differential
- D. neither selective nor differential

17. A Which of the following tests would allow the specific identification of a single microbe under the microscope?

- A. fluorescent antibody (FA)
- B. radioimmunoassay (RIA)
- C. enzyme-linked immunosorbent assay (ELISA)
- D. agglutination.

18. **_B_** In which type of medium will an indicator dye be found?
- A. selective but not differential
 - B. differential but not selective
 - C. both selective and differential
 - D. neither selective nor differential
19. **_C_** Transmission of an infectious disease is most likely during the
- A. incubation period
 - B. prodromal period
 - C. acute period
 - D. decline period
20. **_B_** Diseases that naturally occur in animals and accidentally in humans are called
- A. nosocomial infections
 - B. zoonosis
 - C. vector infections
 - D. muduranes
21. **_A_** An inanimate object that transmits infectious agents between hosts is most appropriately called a
- A. fomite
 - B. carrier
 - C. vector
 - D. reservoir
22. **_C_** A tick transmitting *Rickettsia rickettsii* to a human is an example of a(n)
- A. endemic vector
 - B. opportunistic pathogen
 - C. biological vector
 - D. mechanical vector
23. **_A_** According to recent statistical studies in the US, a person is most apt to acquire a serious infection
- A. in a hospital
 - B. at home
 - C. At school
 - D. While travelling
24. **_C_** The federal agency responsible for disease surveillance in the US is the
- A. USDA
 - B. FDA
 - C. CDC
 - D. EPA
25. **_A_** Which of the following diseases would not normally be spread by a common source?
- A. measles
 - B. typhoid fever
 - C. dysentery
 - D. cholera
26. **_D_** Which of the following is/are considered direct contact infections?
- A. syphilis
 - B. gonorrhoea
 - C. AIDS
 - D. all of the above

Short answer. (1 or 2 points each)

(1) The relative ability of a pathogen to cause disease of greater or lesser severity is that pathogen's ___ **Virulence** ___.

(1) When the virulence of a pathogen is decreased or even completely lost, the pathogen is said to be ___ **Attenuated** ___.

(1) A polymer coat consisting of a dense, well-defined layer closely surrounding the cell is known as the ___ **Capsule** ___.

(1) A large number of bacteria in the bloodstream results in a condition known as ___ **Bacteremia** ___.

(1) Describe one of the properties of microorganisms that grow well on the skin.

Salt tolerant, Acid tolerant, etc

(1) Why are hospital patients more susceptible than "normal" individuals to infectious agents?

They are often immunocompromised.

(1) Why does *Lactobacillus* inhabit the stomach?

Lactobacilli are acid tolerant.

(2) What are the four possible outcomes resulting from the initial contact with a microbe?

Colonization. Infection, Loss, Allergy

(1) What is an infectious dose?

The number of bacteria that will produce disease in 50% of the hosts receiving that dose.

(2) Describe the stages of infection and what is happening in each stage.

Incubation period - bacteria are attaching and multiplying in the host

Prodromium - bacteria have reached sufficient number to illicit the first signs and symptoms of illness.

Period of Invasion (Height of infection)(Fastidium) - bacteria are exerting their maximal effect on the host

Convalescent period - the host begins to recover, signs and symptoms subside, bacterial number decreases, antibody titer continues to increase

(1) Why do Gram-positive Bacteria not produce endotoxins?

They don't have an outer membrane containing Lipid A.

(1) Why are the endotoxins generally not as potent as the exotoxins?

Endotoxins elicit a general response whereas exotoxins target a specific cell or tissue type.

(2) Describe two of the three types of fever.

Continuous - fever remains high (not fluctuating more than 1 degree) for a 24 hour period.

Intermittent - fever is constant for 24 hours but fluctuates by more than 1 degree during that period.

Recurrent - fever subsides within 24 hours but returns

(1) How might preexisting infections compromise an otherwise healthy host?

Preexisting infections may put the host in an immunocompromised situation, inhibiting their ability to fight a secondary infection

(2) Distinguish between selective and differential identification methods. Give an example of a medium used for each purpose.

Selective media will inhibit the growth of one or more types of bacteria. EMB contains methylene blue which inhibits the growth of many gram positive bacteria.

Differential media contain an indicator that changes color due to the metabolic activity of the bacteria - EMB

(1) Why does the antibody titer to an organism rise during convalescence?

Antibody titer does not require an active infection, it is simply a sign of exposure to antigen.

(1) What advantages do agglutination tests have over other immunoassays?

They are much faster although they are much less sensitive.

(1) Distinguish between an endemic disease, an epidemic disease, and a pandemic disease.

Endemic - constant low level occurrence of a disease

Epidemic - increased occurrence of a disease in a region

Pandemic - widespread high level occurrence of a disease over a large area, often global

(1) Distinguish between acute and chronic carriers.

Acute carriers transmit a disease for a short period of time whereas chronic carriers continue to transmit disease even after signs and symptoms of the disease have subsided.

(1) How does herd immunity prevent a non-immune individual from acquiring a disease?

Herd immunity protects non-immune individuals because a pathogen is not amplified through host to host contact.

Short Essay Questions. Please answer 4 of the following 5 short essay questions (5 points each - 5 bonus points possible for answering all five questions)

Describe five factors that are important in the emergence or reemergence of potential pathogens?

Some of the factors include:

Changes in human demographics and behavior.

Changes in technology and industry.

Changes in economic development.

Changes in land use.

International travel.

Changes in the microbial population.

Lack or disruption of sufficient public health infrastructure.

List the three major types of exotoxins and compare exotoxins and endotoxins.

Exotoxins can be A-B toxins, cellulolytic toxins or super-antigens.

Exotoxins differ dramatically from endotoxins. They are fairly large proteins compared to endotoxin which is a relatively small carbohydrate component of the cell's outer membrane. Exotoxins are secreted and are distinct from the bacterial cell whereas endotoxin is an integral part of the bacterial outer membrane. Exotoxins are heat labile and toxoids which can be used for vaccine production can be produced from exotoxins but not endotoxins. Exotoxins are also very antigenic.

What have we learned about the function of the resident microflora through the use of axenic animals?

Axenic animals help us to understand the positive and negative impacts of microbes on the body. For example, axenic animals will live longer as long as they remain in a sterile environment but when they are exposed to microbes that are not particularly virulent they are much more susceptible to disease than "normal" animals, demonstrating the role of resident microbes in development of the immune system. Axenic animals also tend to have vitamin deficiencies demonstrating the role of resident microbes as a source of vitamins for the host. The digestive tract of axenic animals develops differently (such as an enlarged cecum) than that of "normal animals suggesting a role for resident microbes on the development of the adult animal. Axenic animals also do not develop dental caries demonstrating the role of resident microbes in tooth decay. Axenic animals are also less susceptible to amoebic dysentery suggesting a synergistic relationship between the resident microbes and amoeba.

Explain how an organism may become attenuated. Define the role of attenuated organisms in vaccine production and give an example.

Organisms can be attenuated through the loss of virulence factors. This can occur through loss or disruption of virulence genes. This happens frequently when virulent organisms are maintained in the laboratory for several generations. Reintroducing the attenuated organism into a host can result in isolation of non-attenuated strains but many attenuated organisms are permanently avirulent. Attenuated organisms make excellent vaccines because they are nearly identical to the virulent strain with the exception of a specific virulence factor. Therefore, the body will respond to the attenuated strain in nearly the same manner as it would to the virulent strain. The best examples of attenuated vaccines are viral such as the measles and mumps vaccines as well as the rabies vaccine given to animals. This was the strategy used by Pasteur in development of a rabies vaccine.

Describe how an ELISA is used to diagnose a patient with an infectious disease.

There are two types of ELISAs (Enzyme linked immunosorbent assay) - direct and indirect. In the direct ELISA, the surface of a microtiter well is coated with an antibody against a specific microbes. A solutions suspected of containing the microbe is placed in the well and incubated to allow any microbes present to react with the antibody. The well is then washed to remove any non-reacting material. Any microbes that reacted with the coating antibody remain after the washing step. The well is then filled with a solution containing a second antibody to the suspected microbe. This second antibody is conjugated to an enzyme (typically alkaline phosphatase), hence the enzyme-linked part of the name. The well is then washed again to remove any non-reacting antibodies and a chromogenic substrate that is specific for the enzyme conjugated to the second antibody is added to the well. If any conjugated secondary antibody is present it will react with the substrate and produce a colored compound that can be visualized. If the microbe of interest was not present in the initial sample, there would be nothing available to react with the conjugated secondary antibody and there would be no color reaction. The indirect test is analogous to the direct test except you begin with a microtiter well coated with an antigen from the microbe of interest and you would be screening for the presence of reactive antibodies in a sample.