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MULTIPLE CHOICE

1. Organisms that participate in a biological relationship where both benefit from one another are called
   a. parasites.
   b. symbionts.
   c. hosts.
   d. flora.

   ANS: B
   Symbiosis is a relationship where two organisms live together and their association benefits both organisms. Organisms that live in symbiosis are said to be symbionts. Parasites are organisms that live off a host and harm the host. The host is the organism that provides the nutrients to the other organisms. Flora are described as microorganisms that inhabit the body sites of healthy individuals.

   OBJ: Level 1: Recall

2. Parasitism is
   a. a biological relationship between two or more organisms in which both benefit from one another.
   b. a biological relationship between only two organisms in which there are no beneficial or harmful effects to the host.
   c. a biological relationship in which one species gains benefits at the expense of the host.
   d. a synonym for mutualism.

   ANS: C
   When both organisms live together and one organism benefits at the expense of the host, this is parasitism. When both organisms live together and both benefit, this is symbiosis. When both organisms live together and neither benefits, this is commensalism. Mutualism and symbiosis are synonyms.

   OBJ: Level 1: Recall

3. This bacterial state occurs when a host harbors a disease-causing organism, but does not show signs of disease.
   a. Carrier
   b. Transient
   c. Resident
   d. Indigenous

   ANS: A
   Transient, resident, and indigenous refer to particular types of flora associated with the human body, whereas carrier refers to the state in which pathogenic organisms establish themselves in a host without causing disease, but the host can still transmit the infection.

Textbook of Diagnostic Microbiology 6th edition Mahon Test Bank

OBJ: Level 1: Recall

4. Healthy people are colonized by many different bacteria in many different sites. These bacteria are referred to as
   a. transient flora.
   b. carrier flora.
   c. maintenance flora.
   d. indigenous flora.

   ANS: D
   Indigenous flora are usual or normal flora, whereas transient flora are microbial flora that are present at a site temporarily. Carrier and maintenance flora are not types of microbial flora found on the human body.

   OBJ: Level 1: Recall

5. Diabetics may sometimes be infected with their own resident flora. This type of infection is called
   a. an opportunistic infection.
   b. a carrier state.
   c. symbiosis.
   d. a parasitic infection.

   ANS: A
   Opportunistic infections occur when the host has changes in body chemistry associated with age, disease states, and drug or antibiotic effects. Carrier states are those in which a host does not show symptoms of a disease, but it can infect other hosts with pathogenic organisms. Symbiosis is a biological relationship that benefits the host and the organism. A parasitic infection is one in which the parasite receives benefits, but at the expense of the host.

   OBJ: Level 1: Recall

6. Mechanisms used by the skin to prevent infection and protect the underlying tissue from invasion by potential pathogens include all the following, *except*
   a. desquamation of the epithelium.
   b. excretion of lysozyme by sweat glands.
   c. antibiotics that inhibit many microorganisms.
   d. mechanical separation of microorganisms from the tissues.

   ANS: C
   The skin produces fatty acids that inhibit microorganisms, not antibiotics. The remaining three mechanisms are described in the text on page 25.

   OBJ: Level 1: Recall

7. A laboratory professional is testing a new antimicrobial soap. The tech washes her forearm then does a culture of the skin. Which organisms should she most likely expect to find growing in the culture?
   a. Diphtheroids and *Bacillus* spp.
   b. *Staphylococcus epidermidis* and *Propionibacterium*
   c. *S. aureus* and *Propionibacterium*

Textbook of Diagnostic Microbiology 6th edition Mahon Test Bank

d. Diphtheroids and *Propionibacterium*
e. None of these organisms should be found.

ANS: B
Superficial antisepsis of the skin does not kill the *Propionibacterium* and *S. epidermidis* that live in the hair follicles and sebaceous glands. Diphtheroids are found in moist areas such as the axillae and toes. *S. aureus* is typically a pathogen but can be found on healthy skin. Handwashing does not remove *all* bacteria from the skin.

OBJ: Level 1: Interpretation

8. What mechanism allows strict anaerobes to grow in the cervices and areas between the teeth when plaque is present?
   a. A low oxidation-reduction potential occurs at the tooth surface under the plaque.
   b. The bacteria secrete sugar to nourish the strict anaerobes.
   c. The normal flora secrete antibiotics to kill all the other bacteria and allow the strict anaerobes to thrive.
   d. The plaque-causing bacteria secrete an alkaline fluid and change the pH around the tooth.

   ANS: A
   The growth of the plaque-causing bacteria on the tooth's surface contain as many as 10^{11} streptococci per gram, and this amount of bacteria lowers the oxidation-reduction potential at the tooth surface. Strict anaerobes cannot grow in the presence of oxygen, and lowering the oxidation-reduction potential lowers the amount of oxygen at the tooth surface. Normal oral flora organisms do not secrete sugar, antibiotics, or alkaline fluid.

   OBJ: Level 1: Recall

9. The stomach can be considered a first line of defense against microbial infections because
   a. most microorganisms are susceptible to the antibiotics and alkaline pH present in the stomach.
   b. most microorganisms are killed by the liver enzymes that are emptied into the stomach during a meal.
   c. the stomach produces proteases, which attack the lipopolysaccharide cell wall of the organisms.
   d. most microorganisms are susceptible to the acid pH of the stomach.

   ANS: D
   The stomach cells secrete enough acid to create an environment with a pH of approximately 1. Bacteria that are enmeshed in food, spore-forming bacterial species in their spore phase, and the cysts of parasites can survive the extreme pH present in the stomach. The stomach does not produce antibiotics, and liver enzymes do not empty into the stomach during digestion.

   OBJ: Level 1: Recall

10. This type of bacteria is able to live in the colon with little to no oxygen and is the predominant organism.
    a. Anaerobes
    b. Facultative anaerobes
    c. Facultative gram-negative rods

Textbook of Diagnostic Microbiology 6th edition Mahon Test Bank

d. Gram-positive cocci

ANS: A
Anaerobes make up over 90% of the microbial flora of the large intestine. The facultative anaerobes, facultative gram-negative rods, and gram-positive cocci are present in the colon in much smaller numbers than the anaerobes.

OBJ: Level 1: Recall

11. After perforation of the colon, surgeons must guard against infection in the _____ because of leakage of the contents of the colon.
    a. peritoneal cavity
    b. urinary bladder
    c. vaginal flora
    d. renal vein

ANS: A
The peritoneal cavity is the space between the internal organs and the abdominal wall—a normally sterile space. The colon contains lots of bacteria that can cause an infection in this normally sterile space because there are no normal flora or immune system cells here to fight off an infection. The organisms would have no natural defenses to overcome before causing an infection.

OBJ: Level 1: Recall

12. The human body is constantly challenged by pathogens in the environment. It is not infected by every pathogen it encounters because the microbial flora
    a. engulf the pathogenic bacteria.
    b. produce conditions at the microenvironmental level that block colonization.
    c. prime our immune system.
    d. activate and support the action of antigen-presenting cells, cytokines, and cell-mediated immunity.

ANS: B
Several mechanisms are used by microbial flora to ensure that colonization of pathogenic organisms is blocked, such as lowering the reduction-oxidation potential, lowering the pH, producing antimicrobials, and depleting the nutrients present in a particular environment.

OBJ: Level 2: Interpretation

13. The ability of an organism to produce disease in an individual is called
    a. pathogenicity.
    b. iatrogenic infection.
    c. parasitic infection.
    d. opportunistic infection.

ANS: A
An iatrogenic infection occurs as the result of medical treatment or procedure. A parasitic infection occurs when an organism invades a host and only the organism benefits from the biological relationship. An opportunistic infection occurs when the condition of the host changes and the resident flora cause an infection.

Textbook of Diagnostic Microbiology 6th edition Mahon Test Bank

OBJ: Level 1: Recall

14. A patient with an indwelling catheter develops a fever and lethargy. In addition, the urine in the catheter bag has turned a brownish color and smells foul, which suggests an infection is present. What type of infection does this describe?
    a. Opportunistic
    b. Iatrogenic
    c. Pathogenic
    d. Parasitic

    ANS: B
    An iatrogenic infection occurs as the result of medical treatment or procedures. In this case, the use of an indwelling catheter to treat a medical condition has resulted in an infection. An opportunistic infection occurs when a host's condition changes and resident flora are able to cause disease. Pathogenic describes the types of organisms that cause disease, but not a type of infection. A parasitic infection occurs when an organism invades a host and only the organism benefits from the biological relationship.

    OBJ: Level 2: Recall

15. The smaller the number of microorganisms necessary to cause infection in a competent host, the more _____ the microorganism.
    a. opportunistic
    b. parasitic
    c. invasive
    d. virulent

    ANS: D
    Virulence refers to the relative ability of a microorganism to cause disease; more virulent organisms need fewer organisms to cause disease in a host. Opportunistic refers to a type of resident flora that causes infection when the conditions in a host change. A parasitic infection occurs when an organism invades a host and only the organism benefits from the biological relationship. Invasive refers to entering tissue, not the degree of ease with which an organism can cause disease.

    OBJ: Level 1: Recall

16. Factors that determine the pathogenicity and increase the virulence of organisms include all the following, *except*
    a. an organism's ability to avoid phagocytosis.
    b. an organism's ability to produce exotoxins and extracellular enzymes.
    c. an organism's ability to produce infection when host conditions change.
    d. an organism's ability to survive intracellularly when phagocytized.

    ANS: C
    An organism's ability to produce infection when the host conditions change is referred to as an opportunistic pathogen. The other three statements refer to ways that a microorganism can survive the attack of a host's immune system and produce disease.

    OBJ: Level 2: Interpretation

Textbook of Diagnostic Microbiology 6th edition Mahon Test Bank

17. The most common bacterial characteristic that allows for evasion of phagocytosis by the host is called
    a. exotoxin production.
    b. extracellular enzyme production.
    c. pili.
    d. polysaccharide capsule.

    ANS: D
    Organisms possessing a polysaccharide capsule are considered highly virulent because they can evade phagocytosis. Exotoxin and extracellular enzyme production and pili are factors that can increase an organism's virulence. The exotoxins and extracellular enzymes may be used to survive phagocytosis, but these do not help an organism evade phagocytosis. Pili are used to transfer plasmids that may contain the genes for antimicrobial resistance and, therefore, help an organism survive in the host.

    OBJ: Level 1: Recall

18. This is a leukocidin that is lethal to leukocytes and produced by staphylococci.
    a. Panton-Valentine
    b. Lancefield
    c. Hemolysin
    d. Adhesins

    ANS: A
    The Panton-Valentine leukocidin is lethal to leukocytes and contributes to the invasiveness of staphylococci. Lancefield deals with classifying β-hemolytic streptococci on the basis of antigens found on their outer covering. Hemolysins are produced by streptococci, and these lyse red blood cells. Adhesins are cell-surface structures that mediate attachment to other cells.

    OBJ: Level 1: Recall

19. Changes in these host structures can result in lower virulence of a microorganism.
    a. Pili
    b. Adhesin receptors
    c. Surface polysaccharides
    d. Phagocytes

    ANS: B
    Adhesin receptors are structures found on the host cell that are necessary for attachment of bacterial adhesins and the beginnings of an infection. Pili and surface polysaccharides are the main bacterial structures of attachments called adhesins. Phagocytes are white blood cells (WBCs) that engulf invading microorganisms.

    OBJ: Level 1: Recall

20. After attachment to host cells, a pathogen may use the following mechanisms to establish itself and cause disease, *except*:
    a. Uses lactoferrin for iron
    b. Produces an IgA protease that degrades the IgA at mucosal surfaces
    c. Produces lysozyme to kill the host cell

Textbook of Diagnostic Microbiology 6th edition Mahon Test Bank

d. Circumvents host antibodies by shifting key cell-surface antigens

ANS: C
After engulfing bacteria, the host cell releases lysosomal contents that kill the organism. The bacteria do not produce lysozyme.

OBJ: Level 1: Recall

21. Dissemination of a pathogen is
    a. when a pathogen penetrates and grows in tissues.
    b. when a pathogen multiplies intracellularly.
    c. when a pathogen circumvents host antibodies by shifting key cell-surface antigens.
    d. when infection with a pathogen spreads from the initial infection site to distant sites such as organs and tissues.

ANS: D
Invasion of a pathogen allows the microbe to take advantage of the host's transport system (the blood) and seek out other areas that can be infected. This occurs only if the pathogen can elude the host's immune system during this journey. Invasion is when a pathogen penetrates and grows in tissues. Intracellular multiplication of a pathogen occurs when an organism can survive phagocytosis. When a pathogen shifts key cell-surface antigens, it is evading a host's immune system.

OBJ: Level 1: Recall

22. A physician notices that several patients are infected with *Clostridium difficile*, but only a few of the patients are symptomatic for disease. The reason for this discrepancy is
    a. only those strains of the organism carrying the extrachromosomal DNA coding for the toxin gene will produce toxin and cause the individuals to be symptomatic.
    b. only those strains of the organism carrying DNA coding for the toxin within its main DNA molecule will produce toxin and cause the individuals to be symptomatic.
    c. the exotoxin produced contains only the nontoxic portion.
    d. the exotoxin must be produced in conjunction with extracellular enzymes to cause problems.

ANS: A
The exotoxin gene is commonly encoded for by phages, plasmids, or transposons and does not normally reside within an organism's main DNA molecule. Exotoxins are highly characterized molecules that are composed of a nontoxic subunit that binds the toxin to the host cells, allowing attachment of the toxin. Exotoxins exhibit their effects without the aid of extracellular enzymes. Extracellular enzymes are another factor that contributes to the virulence and invasiveness of organisms.

OBJ: Level 2: Interpretation

23. The effects of endotoxins consist of dramatic changes in all the following, *except*
    a. blood pressure.
    b. fluid imbalance.
    c. clotting.
    d. body temperature.

Textbook of Diagnostic Microbiology 6th edition Mahon Test Bank

ANS: B
Unlike shock caused by fluid loss, such as that seen in severe bleeding, septic shock is unaffected by fluid administration. An increase in body temperature occurs within an hour after exposure. Severe hypotension occurs within 30 minutes after exposure. The endotoxin also initiates coagulation, which can result in intravascular coagulation.

OBJ: Level 2: Interpretation

24. A patient is brought to the emergency room with the following symptoms: body temperature of 102° F, low blood pressure, elevated WBC, and disseminated intravascular coagulation. This person has gram-negative rods growing in the blood. What is responsible for these symptoms?
    a. Exotoxin
    b. Extracellular enzymes
    c. Endotoxin
    d. Exfoliating toxin

    ANS: C
    Effects of the lipid A portion of the lipopolysaccharide present in the cell walls of gram-negative bacteria include increased body temperature, hypotension, intravascular clotting, neutropenia, metabolic changes, changes in humoral and cellular immunity, and changes resistance to infection.

    OBJ: Level 3: Synthesis

25. Healthy skin secretes these substances to help prevent colonization by transient and possibly pathogenic organisms.
    a. Long-chain fatty acids
    b. Sebaceous glands
    c. Carbohydrates
    d. Antibodies

    ANS: A
    Long-chain fatty acids produced by the sebaceous glands allow the skin environment to be acidic, leading to a low pH environment. Many pathogens prefer the near-neutral environment in the body to produce disease. Bacteriocidal substances are produced by the microbial flora that colonize the skin, and antibodies are produced by lymphocytes.

    OBJ: Level 1: Recall

26. Lysozyme is
    a. an antibody produced by the skin.
    b. a low-molecular-weight enzyme that hydrolyzes the peptidoglycan layer of bacterial cell walls.
    c. an exotoxin that digests the lipopolysaccharide layer of the bacterial cell wall.
    d. a radical similar to hydrogen peroxide.

    ANS: B
    Antibodies are produced only by the lymphocytes. Exotoxins are produced by bacteria and are toxic to the host. Lysozyme is a low-molecular-weight enzyme that hydrolyzes the peptidoglycan layer of bacterial cell walls.

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OBJ: Level 1: Recall

27. Interferon is a substance produced by the body that inhibits viral replication. Interferon accomplishes this task by
    a. digesting the virus that is attempting to attach to the host cell.
    b. destroying the host cell before the virus can attach and replicate.
    c. binding to surface receptors that stimulate the cell to synthesize enzymes that inhibit viral replication over several days.
    d. stimulating platelets to produce β-lysins.

    ANS: C
    Interferon is produced by eukaryotic cells in response to a viral infection, and it stimulates the cell to synthesize enzymes that inhibit viral replication over several days. Interferons are not enzymes and cannot digest viruses. Destroying the host cell before the virus can attach would be counterproductive, because the purpose is to keep the host cells viable and free of infection. The β-lysin's cationic proteins are produced by platelets during coagulation and are active against gram-positive bacteria, not viruses.

    OBJ: Level 2: Interpretation

28. All the following activities must occur for phagocytosis to take place and be effective in host defense, *except*
    a. attachment of the particle to the phagocyte.
    b. ingestion.
    c. killing.
    d. migration of lymphocytes to the area of infection (chemotaxis).

    ANS: D
    Phagocytes are neutrophils or macrophages. Lymphocytes are not phagocytic and cannot engulf bacteria.

    OBJ: Level 1: Recall

29. This process results in enhanced phagocytosis by neutrophils.
    a. Opsonization
    b. Chemotaxis
    c. Digestion
    d. Glycolysis

    ANS: A
    Chemotaxis is the process of phagocytes migrating toward the site of the infection. Digestion is when the contents of the lysozyme are mixed with the phagocytized bacteria. Glycolysis is a metabolic process where glucose is broken down and energy is generated.

    OBJ: Level 1: Recall

30. One of the most effective defenses bacteria have against phagocytosis is
    a. enzymes.
    b. the capsule.
    c. plasmids.

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d. lipopolysaccharide layer.

ANS: B
Enzymes facilitate host cell destruction but do not have any effect on phagocytosis. Plasmids carry small pieces of DNA that can code for toxins, enzymes, and antibiotic resistance. The lipopolysaccharide layer acts as an endotoxin that causes septic shock.

OBJ: Level 1: Recall

31. Innate immunity consists of which of the following components?
a. Physical and chemical barriers such as the skin and mucous membranes
b. Blood proteins that act as mediators of infection
c. Cells capable of phagocytosis
d. All of the above are part of the innate immune system

ANS: D
Innate immunity includes (1) physical and chemical barriers, such as the skin and mucous membranes; (2) blood proteins that act as mediators of infection; and (3) a cellular mechanism capable of phagocytosis, such as neutrophils and macrophages, and other leukocytes such as natural killer cells.

OBJ: Level 2: Interpretation

32. The major constituents of the adaptive or specific immune response are
a. neutrophils.
b. macrophages.
c. monocytes.
d. lymphocytes.

ANS: D
Lymphocytes produce antibodies in response to specific antigens present in the blood. Neutrophils, macrophages, and monocytes are all phagocytic cells that function in innate immunity, not the specific immune response.

OBJ: Level 1: Recall

33. This class of antibodies is usually found as a pentamer.
a. IgM
b. IgG
c. IgA
d. IgE

ANS: A
IgM is made up of five basic immunoglobulin subunits and is considered a pentamer. IgG is a monomer, IgA is a dimer, and IgE is a monomer.

OBJ: Level 1: Recall

34. A subsequent exposure to the same antigen elicits a(n) _____, characterized by a rapid increase in IgG antibody associated with higher levels, a prolonged elevation, and a more gradual decline in antibody levels.
a. primary immune response

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b. anamnestic immune response
c. opsonin immune response
d. innate immune response

ANS: B
The primary immune response consists of production of IgM antibodies. The innate immune response does not consist of antibody production but rather physical and chemical barriers to infection and phagocytosis.

OBJ: Level 1: Recall

35. These are low-molecular-weight proteins secreted by T cells.
a. Antibodies
b. Opsonins
c. Lymphokines
d. Lysozyme

ANS: C
Antibodies are produced by B cells. Opsonins are antibodies or pieces of complement that help make a pathogen ready to be phagocytized. Lysozyme is the enzyme present in host cell vacuoles that assist in killing a phagocytized microorganism. Lymphokines are produced by T cells as a result of antigen binding, activation, cell division, and differentiation.

OBJ: Level 1: Recall

36. Immunity to intracellular bacterial pathogens, such as *Mycobacterium tuberculosis*, is primarily cell mediated, through the activities of
a. interferons and macrophages.
b. antibodies and lymphokines.
c. lysozyme, T lymphocytes, and antibodies.
d. T lymphocytes, lymphokines, and macrophages.

ANS: D
T lymphocytes, lymphokines, and macrophages are used by the immune system to battle intracellular pathogens most effectively. Interferons are useful against viruses, not bacteria. Macrophages are effective against intracellular pathogens because they are phagocytes. Antibodies are not useful against intracellular pathogens because they cannot reach the pathogen that lives inside the cell. Lysozyme is an enzyme that is used to kill bacteria once they are phagocytized.

OBJ: Level 2: Interpretation

37. Pathogens can be transmitted through all the following routes, *except*
a. ingestion.
b. handwashing.
c. sexual contact.
d. air.

ANS: B
Handwashing is a major method to prevent spread of infections. Pathogens can be transmitted by ingestion, sexual contact, and air.

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OBJ: Level 1: Recall

38. Because infections can be encountered via the air, _____ can cause transmission of some pathogens.
    a. cuts
    b. eyes
    c. coughing
    d. eating

    ANS: C
    Airborne infections are the most commonly encountered infections. They are transmitted by droplets in the air that can be generated by coughing or sneezing. Cuts, eyes, and children are not usual pathways for airborne transmission of a pathogen.

    OBJ: Level 1: Recall

39. The resulting disease from this route of transmission is a disease of animals that is transmitted to humans.
    a. Sexual contact
    b. Zoonotic
    c. Airborne
    d. Ingestion

    ANS: B
    Sexual contact, airborne, and ingestion are all routes of transmission for diseases of humans that are passed from person to person. Zoonotic describes diseases of animals that infect humans.

    OBJ: Level 1: Recall

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