

Human Microbiota and Bacterial Pathogenesis - MCQs

1. Which of the following is a major benefit provided by the normal gut microbiota?

A. Production of viral particles that aid digestion

B. Synthesis of essential vitamins such as vitamin K

C. Destruction of intestinal epithelial cells

D. Production of endotoxins that enhance immunity

E. Facilitation of pathogenic bacterial growth

2. A 25-year-old woman develops diarrhea after taking broad-spectrum antibiotics. The most likely causative organism is:

A. Clostridium difficile

B. Escherichia coli

C. Lactobacillus acidophilus

D. Streptococcus pyogenes

E. Bacteroides fragilis

3. The skin microbiota is dominated by which type of bacteria?

A. Anaerobic Gram-negative rods

B. Aerobic Gram-negative rods

C. Gram-positive cocci and rods

D. Spore-forming Gram-negative rods

E. Acid-fast bacilli

4. Which of the following mechanisms best describes how bacterial capsules enhance pathogenicity?

A. Enhancing phagocytosis

B. Preventing complement activation and phagocytosis

C. Increasing antibody production

D. Enhancing toxin production

E. Increasing bacterial motility

5. Which bacterial component is responsible for endotoxic shock in Gram-negative infections?

A. Peptidoglycan

B. Lipoteichoic acid

C. Lipopolysaccharide (LPS)

D. Capsule

E. Flagellin

6. A 3-day-old neonate develops meningitis. The infection is traced to the mother's vaginal microbiota. Which organism is most likely responsible?

A. Escherichia coli (K1 strain)

B. *Listeria monocytogenes*

C. Group B Streptococcus (*Streptococcus agalactiae*)

D. *Staphylococcus aureus*

E. *Neisseria meningitidis*

7. Which of the following best explains the role of quorum sensing in bacterial pathogenesis?

A. It enables bacteria to detect host cytokines

B. It allows bacteria to coordinate gene expression for virulence factors

C. It enhances bacterial motility in host tissues

D. It allows bacterial DNA repair under stress

E. It promotes bacterial transformation

8. Disruption of the normal oral microbiota may predispose to which of the following?

A. Dental caries and periodontal disease

B. Chronic sinusitis

C. Gastroenteritis

D. Pharyngitis due to *Streptococcus pyogenes*

E. Oral thrush caused by viruses

9. Which of the following statements about exotoxins is correct?

- A. They are heat stable and form part of the bacterial cell wall
- B. They are lipopolysaccharides produced by Gram-negative bacteria
- C. They are proteins secreted by bacteria and can be highly antigenic**
- D. Their effects are limited to Gram-negative infections
- E. They are only released upon bacterial lysis

10. A patient with cystic fibrosis develops chronic *Pseudomonas aeruginosa* infection. Which factor contributes most to persistence of infection?

A. Biofilm formation

- B. Endotoxin production
- C. Motility via flagella
- D. Sporulation
- E. Toxin A production

11. A hospitalized patient develops sepsis with *Enterococcus faecalis* after long-term antibiotic therapy. This is best described as:

- A. Primary infection
- B. Zoonotic infection

C. Opportunistic infection

- D. Nosocomial viral infection

E. Recurrent exogenous infection

12. Which of the following bacterial virulence mechanisms directly promotes intracellular survival in macrophages?

A. Capsule synthesis

B. Inhibition of phagolysosome fusion

C. Production of endotoxin

D. Flagellar motility

E. Secretion of exotoxin A

13. A 45-year-old diabetic patient develops a chronic foot ulcer. The persistence of infection despite antibiotics is likely due to:

A. Endotoxin production

B. Capsule formation

C. Biofilm development

D. Phage conversion

E. Plasmid loss

14. Which of the following toxins inhibits protein synthesis by inactivating elongation factor-2 (EF-2)?

A. Diphtheria toxin

B. Cholera toxin

C. Shiga toxin

- D. Tetanus toxin
- E. Botulinum toxin

15. The vaginal microbiota dominated by *Lactobacillus* species contributes to host defense mainly by:

- A. Releasing endotoxins
- B. Producing lactic acid to maintain low pH**
- C. Increasing neutrophil apoptosis
- D. Blocking mucosal IgA activity
- E. Producing hemolysins

16. Horizontal gene transfer of antibiotic resistance via bacteriophages occurs through which process?

- A. Transformation
- B. Transduction**
- C. Conjugation
- D. Mutation
- E. Recombination



Answer Key and Explanations

1. Correct Answer: B

Explanation: The gut microbiota synthesizes vitamins such

as vitamin K and B-complex vitamins and competes with pathogens for nutrients and attachment sites.

2. Correct Answer: A

Explanation: Antibiotics disrupt the gut microbiota, allowing overgrowth of toxin-producing *C. difficile* leading to pseudomembranous colitis.

3. Correct Answer: C

Explanation: Skin microbiota mainly includes Gram-positive bacteria such as *Staphylococcus epidermidis* and *Corynebacterium* species.

4. Correct Answer: B

Explanation: Capsules prevent complement deposition and phagocytosis, helping bacteria like *S. pneumoniae* evade host immune clearance.

5. Correct Answer: C

Explanation: The lipid A portion of LPS in Gram-negative bacteria triggers cytokine release and septic shock.

6. Correct Answer: C

Explanation: Group B *Streptococcus* is part of vaginal flora and a major cause of neonatal sepsis and meningitis.

7. Correct Answer: B

Explanation: Quorum sensing regulates virulence factor expression such as toxin production and biofilm formation once population density is sufficient.

8. Correct Answer: A

Explanation: Loss of microbial balance allows *Streptococcus mutans* and anaerobes to overgrow, producing acids that damage enamel and gums.

9. Correct Answer: C

Explanation: Exotoxins are secreted proteins that act at specific targets, often neutralized by antibodies (toxoids).

10. Correct Answer: A

Explanation: Biofilms provide resistance to antibiotics and immune defenses, allowing persistent infection in cystic fibrosis lungs.

11. Correct Answer: C

Explanation: Antibiotic therapy disrupts normal microbiota, enabling opportunistic pathogens like *Enterococcus* to overgrow and cause infection.

12. Correct Answer: B

Explanation: Pathogens such as *Mycobacterium*

tuberculosis block phagolysosome fusion, allowing replication inside macrophages.

13. Correct Answer: C

Explanation: Biofilm-associated bacteria in chronic wounds are protected from antibiotics and immune responses.

14. Correct Answer: A

Explanation: *Corynebacterium diphtheriae* produces diphtheria toxin that ADP-ribosylates EF-2, halting protein synthesis.

15. Correct Answer: B

Explanation: *Lactobacillus* maintains vaginal pH around 4.5, inhibiting pathogenic organisms such as *Candida* and *Gardnerella*.

16. Correct Answer: B

Explanation: Transduction involves bacteriophages transferring DNA, including antibiotic resistance genes, between bacteria.