

Chapter 01: Bacterial Cell Structure, Physiology, Metabolism, and Genetics
Mahon: Textbook of Diagnostic Microbiology, 6th Edition

MULTIPLE CHOICE

1. To survive, microbial inhabitants have learned to adapt by varying all of the following, *except*
 - a. growth rate.
 - b. growth in all atmospheric conditions.
 - c. growth at particular temperatures.
 - d. bacterial shape.

ANS: D

The chapter begins by discussing the way microbial inhabitants have had to evolve to survive in many different niches and habitats. It discusses slow growers, rapid growers, and replication with scarce or abundant nutrients, under different atmospheric conditions, temperature requirements, and cell structure. Bacterial shape as a form of evolution is not discussed.

OBJ: Level 2: Interpretation

2. Who was considered the father of protozoology and bacteriology?
 - a. Anton van Leeuwenhoek
 - b. Louis Pasteur
 - c. Carl Landsteiner
 - d. Michael Douglas

ANS: A

The book discusses Anton van Leeuwenhoek as the inventor of the microscope and the first person to see the “beasties.” So they dubbed him the father of protozoology and bacteriology. The other three individuals were not discussed.

OBJ: Level 1: Recall

3. Prokaryotic cells have which of the following structures in their cytoplasm?
 - a. Golgi apparatus
 - b. Ribosomes
 - c. Mitochondria
 - d. Endoplasmic reticulum

ANS: B

All the structures listed are found in eukaryotic cells, but ribosomes are the only ones that apply to prokaryotic cells.

OBJ: Level 1: Recall

4. This form of DNA is commonly found in eukaryotic cells.
 - a. Linear
 - b. Circular
 - c. Plasmid
 - d. Colloid

ANS: A

Circular and plasmid DNA are usually found only in bacteria, not eukaryotic cells. Colloid is a property of protein molecules and is not associated with nucleotides.

OBJ: Level 1: Recall

5. The nuclear membrane in prokaryotes is
 - a. missing.
 - b. impenetrable.
 - c. a classic membrane.
 - d. a lipid bilayer membrane.

ANS: A

Prokaryotic cells do not have any membrane-bound structures in the cytoplasm including a structured nucleus.

OBJ: Level 1: Recall

6. A microorganism that is a unicellular organism and lacks a nuclear membrane and true nucleus belongs to which classification?
 - a. Fungi
 - b. Bacteria
 - c. Algae
 - d. Parasite

ANS: B

Fungi, algae, and parasites are unicellular eukaryotic organisms that contain a true nucleus. Bacteria are prokaryotic and do not contain a true nucleus or nuclear membrane.

OBJ: Level 1: Recall

7. In the laboratory, the clinical microbiologist is responsible for all the following, *except*
 - a. isolating microorganisms.
 - b. selecting treatment for patients.
 - c. identifying microorganisms.
 - d. analyzing bacteria that cause disease.

ANS: B

Clinical microbiologists do not select the treatment for patients. They provide the doctor with the name of the organism and the antibiotics that can kill the bacteria, but not in the final selection of treatment protocols.

OBJ: Level 2: Recall

8. What enables the microbiologist to select the correct media for primary culture and optimize the chance of isolating a pathogenic organism?
 - a. Determining staining characteristics
 - b. Understanding the cell structure and biochemical pathways of an organism
 - c. Understanding the growth requirements of potential pathogens at specific body site
 - d. Knowing the differences in cell walls of particular bacteria

ANS: C

By understanding growth requirements, a microbiologist can maximize the chance of the organism being isolated from a culture. The other three choices are used to identify a bacterium once it has grown on media.

OBJ: Level 2: Interpretation

9. A clinical laboratory scientist is working on the bench, reading plates, and notices that a culture has both a unicellular form and a filamentous form. What type of organism exhibits these forms?
- Virus
 - Fungi
 - Bacteria
 - Parasite

ANS: B

Viruses typically only have one form and would not grow on plate media. Bacteria have two forms: a vegetative cell and spore form. Parasites may have trophozoite, cysts, egg, etc. Fungi are the organism classification that may have both unicellular yeast forms and filamentous hyphal forms in the same culture plate.

OBJ: Level 2: Interpretation

10. All of the following statements are true about viruses, *except*:
- Viruses consist of DNA or RNA but not both.
 - Viruses are acellular but are surrounded by a protein coat.
 - Viruses can infect bacteria, plants, and animals.
 - Viruses do not need host cells to survive and grow.

ANS: D

Viruses need to have a host cell because they do not have the ability to reproduce or nourish themselves without the host's cellular mechanisms.

OBJ: Level 2: Interpretation

11. Diagnostic microbiologists apply placement and naming of bacterial organisms into all the following categories, *except*
- order.
 - family.
 - genus.
 - species.

ANS: A

Clinical microbiologists use the family, genus, and species taxonomic categories to identify species that are important for diagnostic diseases.

OBJ: Level 1: Recall

12. Bacterial species that exhibit phenotypic differences are considered
- biovarieties.
 - serovarieties.
 - phagevarieties.
 - subspecies.

ANS: D

Biovarieties vary based on biochemical test results, serovarieties vary based on serologic test results, and phagevarieties is a fictitious word.

OBJ: Level 2: Interpretation

13. What structure is described as a phospholipid bilayer embedded with proteins and sterols that regulates the type and amount of chemicals that pass in and out of a cell?
- Cell wall
 - Mitochondria
 - Endoplasmic reticulum
 - Plasma membrane

ANS: D

The cell wall is the outer covering made up of lipids. The mitochondria is a cellular organelle that is considered the powerhouse of the cell (electron transport and oxidative phosphorylation occur here). The endoplasmic reticulum is a cellular organelle where protein synthesis occurs.

OBJ: Level 1: Recall

14. What makes the interior of the plasma membrane potentially impermeable to water-soluble molecules?
- The hydrophobic tails of the phospholipid molecules are found there.
 - The hydrophilic tails of the phospholipid molecules are found there.
 - The ion channels are found there.
 - The cholesterol molecules in the plasma membrane are found solely in the interior of the membrane.

ANS: A

The plasma membrane is designed so that the hydrophilic heads of the phospholipid molecules are positioned to make contact with the intracellular and extracellular fluids. The hydrophobic tails of the phospholipid molecules face away from the fluids and form the interior of the plasma membrane. The tails of the phospholipid molecules are hydrophobic, not hydrophilic. The ion channels extend through the cellular membrane. The cholesterol molecules also extend through the plasma membrane.

OBJ: Level 2: Interpretation

15. The function of a cell wall is to
- regulate the transport of macromolecules in and out of the cell.
 - provide rigidity and strength to the exterior of the cell.
 - provide reserve energy to the eukaryotic cell.
 - protect the eukaryote from predators.

ANS: B

The plasma membrane regulates the transport of macromolecules in and out of the cell, not the cell wall. The mitochondria provide energy to the eukaryotic cell. Cell walls are not able to protect a eukaryotic cell from predators.

OBJ: Level 1: Recall

16. Name the numerous short (3 to 10 μm) projections that extend from the cell surface and are used for cellular locomotion.
- Flagella
 - Mitochondria
 - Cilia
 - Phospholipid

ANS: C

By definition, cilia are short projections extending from the cell surface and are used for locomotion, whereas flagella are longer projections used for locomotion. Mitochondria are cellular organelles responsible for electron transport and oxidative phosphorylation. Phospholipids are polar molecules that form the plasma membrane.

OBJ: Level 1: Recall

17. A microbiology technologist performs a traditional bacterial stain on a colony from a wound culture that is suspected to contain bacteria from the genus *Clostridium*. The unstained areas in the bacterial cell observed by the technologist are called
- cilia.
 - ribosomes.
 - endospores.
 - mitochondria.

ANS: C

Ribosomes are small circular areas used for protein synthesis that are not visible on a traditional stain. Cilia are short projections on the outside of the plasma membrane used for locomotion. Mitochondria are cellular organelles used for energy production.

OBJ: Level 2: Interpretation

18. This constituent of a gram-positive cell wall absorbs crystal violet but is not dissolved by alcohol, thus giving the gram-positive cell its characteristic purple color.
- Mycolic acid
 - Cholesterol
 - Carbolfuchsin
 - Peptidoglycan

ANS: D

Mycolic acid is part of the cell wall of the *Mycobacterium* and *Nocardia* spp., but does not play a part in the Gram stain. Cholesterol is also part of the cell membrane, not the cell wall, so it does not play a part in the Gram stain. Carbolfuchsin is a stain used in bacteriology.

OBJ: Level 2: Interpretation

19. Mycobacteria have a gram-positive cell wall structure with a waxy layer containing these two compounds.
- Glycolipids and mycolic acid
 - Glycolipids and phospholipids
 - Mycolic acid and lipopolysaccharides
 - Lipopolysaccharides and phospholipids

ANS: A