Brock Biology of Microorganisms 16th edition Madigan Test Bank

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***Brock Biology of Microorganisms, 16e* (Madigan et al.)**
Chapter 2 Microbial Cell Structure and Function

2.1 Multiple Choice Questions

1) Bacteria with type IV pili
A) possess tubular or stalk-like extensions of their cells.
B) likely exhibit twitching motility.
C) have capsules that promote dehydration.
D) live in aquatic environments.
Answer: B
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.6
Learning Objective: 2.II

2) The terms "run" and "tumble" are generally associated with
A) eukaryotic cells.
B) nutrient transport.
C) chemotaxis.
D) clustering of certain rod-shaped bacteria.
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.11
Learning Objective: 2.III TBEXAM.COM

3) The cytoplasmic membrane could best be described as
A) an impermeable barrier.
B) a passive conduit for intracellular transport.
C) a highly selective permeability barrier.
D) a rigid structure that protects the cell.
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
Learning Objective: 2.I

4) The use of the Gram stain in microbiology is important because it differentiates
A) *Bacteria* from *Archaea*.
B) prokaryotic from eukaryotic cells.
C) bacterial cells with different types of cell walls.
D) archaeal cells with different types of metabolism.
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.3
Learning Objective: 2.I

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5) Some archaea have unique phospholipids in their cytoplasmic membrane that
A) form a monolayer due to the presence of diglycerol tetraethers.
B) form a bilayer due to the presence of sterols.
C) form a stable ring structure due to the presence of crenarchaeol.
D) form a bilayer due to the presence of phosphatidylethanolamine.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
Learning Objective: 2.I

6) Transport proteins located in the cytoplasmic membrane are necessary when
A) diffusion will not allow adequate amounts of a substance to enter the cell.
B) movement into the cell is against a concentration gradient.
C) the level of nutrients in nature is very low.
D) nutrient concentration is very low in the environment, transport is needed against the concentration gradient, or diffusion is not possible.
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.3
Learning Objective: 2.I

7) Cells move polar molecules across the cell membrane against a concentration gradient using
A) energy and transport proteins.
B) simple diffusion.
C) modifications to membrane lipids.
D) random molecular movement.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
Learning Objective: 2.I

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8) *Bacteria* stain as gram-positive or gram-negative because of differences in the cell
A) wall.
B) cytoplasm.
C) nucleus.
D) chromosome.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.3
Learning Objective: 2.I

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9) You are given an electron micrograph of a bacterial cell. In the micrograph, you can clearly see three thin layers of different densities surrounding the cell. Based on the micrograph, you can infer that this cell is _____ and would appear _____ after application of the Gram stain procedure.
A) gram-positive / purple
B) gram-negative / pink
C) gram-positive / pink
D) gram-negative / purple
Answer: B
Bloom's Taxonomy: 3-4: Applying/Analyzing
Chapter Section: 2.3
Learning Objective: 2.I

10) The cell wall of a gram-positive bacterium is composed of a thick _____ layer.
A) protein
B) poly-β-hydroxybutyric acid (PHB)
C) lipopolysaccharides (LPS)
D) peptidoglycan
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.3
Learning Objective: 2.I

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11) You have discovered a new coccoid-shaped microorganism with no nucleus, a rigid cell wall, and a diameter of 2 µm. Chemical tests reveal that its cell wall does NOT contain peptidoglycan. The new microorganism is
A) most likely a bacterium.
B) most likely a eukaryote.
C) most likely an archaeon.
D) either a bacterium or an archaeon.
Answer: C
Bloom's Taxonomy: 3-4: Applying/Analyzing
Chapter Section: 2.3
Learning Objective: 2.I

12) The lipopolysaccharide (LPS) layer is found ONLY in the cell walls of
A) gram-positive *Bacteria*.
B) gram-negative *Bacteria*.
C) *Archaea*.
D) *Eukarya*.
Answer: B
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.4
Learning Objective: 2.I

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13) An endotoxin is
A) the toxic portion of the LPS.
B) a toxin produced within archaeal cells.
C) a toxin known for its primary attack on the epidermis of mammals.
D) a toxin produced in the periplasm of most bacteria.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.4
Learning Objective: 2.I

14) Hydrolytic enzymes function in the
A) initial degradation of nutrients.
B) transport of substrates within the cell.
C) chemotactic response, particularly in gram-negative *Bacteria*.
D) regeneration of the periplasm.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.4
Learning Objective: 2.I

15) Using phase contrast microscopy on a wet mount of live cells, you observe motile bacilli moving rapidly and randomly through the field of view, changing directions after a brief tumble and taking off in a different direction. These cells are exhibiting _____ motility.
A) twitching
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B) swimming
C) gliding
D) twitching or gliding
Answer: B
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.9
Learning Objective: 2.III

16) Which of the following statements is FALSE?
A) A flagellar protein subunit is flagellin.
B) In flagellar motion, the basal body acts as a motor.
C) Flagellar rotation generates ATP.
D) The hook is the wider region at the base of the flagellum.
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.9
Learning Objective: 2.III

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17) Which of the following statements is TRUE?
A) Fimbriae are generally longer and less numerous than flagella.
B) Fimbriae are involved in genetic exchange between cells.
C) Hami are common in *Bacteria* but not found in *Archaea*.
D) Fimbriae are usually shorter than flagella, whereas pili are involved in genetic exchange.
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.6
Learning Objective: 2.II

18) Cellular inclusions in prokaryotic cells serve to
A) store energy rich compounds.
B) protect DNA.
C) position cells in the appropriate environment for survival.
D) store energy rich compounds and position cells in the appropriate environment for survival.
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.7
Learning Objective: 2.II

19) A major function of prokaryotic gas vesicles is to
A) confer buoyancy on cells by decreasing their density.
B) serve as a reservoir for oxygen and carbon dioxide.
C) keep the cell's organelles separated during flagellar motion.
D) store oxygen for aerobic growth when oxygen becomes depleted in the environment.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.7
Learning Objective: 2.II

20) The membrane of a gas vesicle is composed of
A) various phospholipids.
B) proteins.
C) carbohydrates.
D) both glycoproteins and phospholipids.
Answer: B
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.7
Learning Objective: 2.II

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21) What is the biological function of endospores?
A) They are bacterial reproductive structures.
B) They enable organisms to endure extremes of temperature, drying, and nutrient depletion.
C) They transport toxins.
D) Endospores can serve as reproductive structures, enable survival in harsh environments, and transport toxins.
Answer: B
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.8
Learning Objective: 2.II

22) The lipids in the cytoplasmic membrane of *Bacteria* and _____ contain ester linkages, while the cytoplasmic membrane of _____ contain ether linkages.
A) *Archaea* / *Eukarya*
B) *Archaea* / fungi
C) *Eukarya* / prokaryotes
D) *Eukarya* / *Archaea*
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
Learning Objective: 2.I

23) Based on your knowledge of porins from the chapter, what is the best description of the specific type of porin called an aquaporin?
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A) Water transport proteins
B) Molecules that prevent water from crossing a membrane
C) Enzymes involved in the generation of water within cells
D) Cations bound to water molecules
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.4
Learning Objective: 2.I

24) _____ are charged molecules that are partially responsible for the _____ charge of the gram-positive bacterial cell surface.
A) Diaminopimelic acids / positive
B) Teichoic acids / negative
C) Phospholipids / negative
D) Peptide interbridges / neutral
Answer: B
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.3
Learning Objective: 2.I

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25) Although the inner leaflet of the gram-negative outer membrane is composed mainly of phospholipids, the outer leaflet of the outer membrane contains
A) pseudopeptidoglycans.
B) lipoteichoic acids.
C) poly-β-hydroxybutyric acids (PHB).
D) lipopolysaccharides (LPS).
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.4
Learning Objective: 2.I

26) One of the many types of proteins found in the cytoplasmic membrane that is involved in the chemotactic response is called a
A) hydrolytic enzyme.
B) chemoreceptor.
C) binding protein.
D) porin.
Answer: B
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.11
Learning Objective: 2.III

27) When does endospore formation commence?
A) When bacterial growth ceases due to limitation of an essential nutrient
B) When the bacterium is undergoing binary fission
C) When bacteria are dividing exponentially
D) Following bacterial death
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.8
Learning Objective: 2.II

28) Which is/are a function(s) of the cytoplasmic membrane in prokaryotes?
A) It functions as a permeability barrier.
B) It is an anchor for many proteins involved in bioenergetic reactions and transport.
C) It is a major site of energy conservation.
D) It serves as a permeability barrier, a docking station for proteins involved in bioenergetics reactions and transport, and a site for energy conservation.
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
Learning Objective: 2.I

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29) All eukaryotes contain
A) a membrane-enclosed nucleus.
B) mitochondria.
C) hydrogenosomes.
D) a nucleus, mitochondria, and hydrogenosomes.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.13
Learning Objective: 2.IV

30) Mitochondria and hydrogenosomes are similar in that they both
A) are the site of energy production in eukaryotic cells.
B) evolved via endosymbiosis of bacterial cells.
C) are the site of aerobic respiration.
D) evolved via endosymbiosis and are sites for aerobic respiration and energy production.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.13
Learning Objective: 2.IV

31) Membrane-enclosed organelles, such as nuclei, lysosomes, endoplasmic reticulum, mitochondria, and chloroplasts
A) form specialized compartments within eukaryotic cells for specific functions to occur.
B) increase the structural complexity of eukaryotic cells.
C) help large eukaryotic cells overcome the limitations of diffusion imposed by their large cell size.
D) increase structural complexity, help eukaryotes overcome diffusion limitation due to their size, and form specialized environments for specific functions to occur.
Answer: A
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.13
Learning Objective: 2.IV

32) The Golgi complex functions to
A) modify and secrete proteins to the external environment.
B) sort proteins used within the cell.
C) both modify and sort proteins into those destined for secretion and those that function in membrane structures.
D) synthesize proteins.
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.15
Learning Objective: 2.IV

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33) The membrane-enclosed compartments that contain digestive enzymes in eukaryotic cells are called
A) cristae.
B) mitosomes.
C) lysosomes.
D) stromas.
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.15
Learning Objective: 2.IV

34) Where within a eukaryotic cell is ribosomal RNA (rRNA) synthesized?
A) Cytoplasm
B) Lysosome
C) Mitochondrion
D) Nucleolus
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.13
Learning Objective: 2.IV

35) The energy source derived from the charge separation across the cytoplasmic membrane is referred to as
A) the proton motive force.
B) carbohydrate charging.
C) adenosine triphosphate.
D) the voltage source.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
Learning Objective: 2.I

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36) Based on the table of attributes given below, which of the following statements are FALSE about the two organisms?

Characteristic	Bacterium A	Bacterium B
Endospore formation	yes	no
Capsule	no	yes
Type IV pili	yes	no
Flagella	no	no
Morphology	bacillus	bacillus

A) Bacterium A is more resistant to heat and ultraviolet light.
B) Bacterium B likely forms a slime layer better than Bacterium A.
C) Bacterium B is likely to exhibit motility.
D) Both bacteria may attach to surfaces.
Answer: C
Bloom's Taxonomy: 3-4: Applying/Analyzing
Chapter Section: 2.5, 2.6, 2.9
Learning Objective: 2.I, 2.II, 2.III

37) Small acid-soluble proteins (SASPs) protect DNA from ultraviolet light and are found in high numbers within
A) gram-positive *Bacteria.*
B) endospores.
C) inclusion bodies.
D) gram-negative *Bacteria*.
Answer: B
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.8
Learning Objective: 2.II

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38) The peptide interbridge crosslinking between peptidoglycan layers is found ONLY in the cell walls of
A) *Archaea.*
B) *Eukarya.*
C) gram-positive *Bacteria.*
D) gram-negative *Bacteria.*
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.3
Learning Objective: 2.I

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39) Type IV pili are involved in
A) attachment of cells to surfaces.
B) twitching motility.
C) pathogenesis.
D) attachment to surfaces, twitching motility, and pathogenesis.
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.6
Learning Objective: 2.II

40) Eukaryotes have _____ in their cytoplasmic membranes, which serve to strengthen and stabilize the membrane and make it less flexible.
A) ether bonds
B) lipids
C) sterols
D) phospholipids
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.5
Learning Objective: 2.I

41) The rigid layer that is present in the cell walls of *Bacteria* that is primarily responsible for the strength of the wall is known as
A) pseudomurein.
B) S-layer.
C) cellulose.
D) peptidoglycan.
Answer: D
Bloom's Taxonomy: 3-4: Applying/Analyzing
Chapter Section: 2.2
Learning Objective: 2.I

42) Some of the intestinal symptoms elicited by pathogens such as *Salmonella*, *Shigella*, and *Escherichia* are due to the presence of
A) pseudomurein.
B) S-layers.
C) lipopolysaccharides.
D) peptidoglycan.
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.4
Learning Objective: 2.I

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43) Using bright-field microscopy to look at a slide prepared with a basic dye you observe cells with a clear inner compartment within the cell at 400X magnification. The cell is most likely a(n)
A) prokaryote.
B) bacterium.
C) archaeon.
D) eukaryote.
Answer: D
Bloom's Taxonomy: 3-4: Applying/Analyzing
Chapter Section: 2.13
Learning Objective: 2.IV

44) While examining cellular material, you find that organelle DNA is present. What organelle(s) must be within the sample?
A) Lysosomes
B) Rough or smooth endoplasmic reticulum
C) Chloroplasts or mitochondria
D) Golgi complex
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.14
Learning Objective: 2.IV

45) Which of the following is evidence for the endosymbiotic theory?
A) Mitochondria have circular DNA. TBEXAM.COM
B) The nucleus is surrounded by a nuclear membrane.
C) Chloroplasts have thylakoids.
D) The rough endoplasmic reticulum has ribosomes.
Answer: A
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.14
Learning Objective: 2.IV

46) Actin is found within
A) the prokaryotic cytoskeleton.
B) eukaryotic microfilaments.
C) eukaryotic microtubules.
D) eukaryotic intermediate filaments.
Answer: B
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.15
Learning Objective: 2.IV

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47) Which of the following statements is TRUE?
A) Eukaryotic flagella rotate in the same manner as prokaryotic flagella.
B) Lysosomes synthesize proteins and carbohydrates.
C) Cilia generally move with a slow, whip-like motion.
D) The major function of the rough endoplasmic reticulum is lipid synthesis.
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.15
Learning Objective: 2.IV

48) Archaeans have archaella that rotate like bacterial flagella though they
A) have greater diameters than bacterial flagella.
B) are longer than bacterial flagella.
C) only rotate in one direction.
D) consist of multiple protein types.
Answer: D
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.9
Learning Objective: 2.III

49) You find endospores of a particular species. Which of the following is most likely TRUE of this species?
A) It is an archaean.
B) It is a gram-positive bacterium.
C) It is a gram-negative bacterium.
D) It is equally likely to be an archaean, a gram-positive bacterium, or a gram-negative bacterium.
Answer: B
Bloom's Taxonomy: 3-4: Applying/Analyzing
Chapter Section: 2.8
Learning Objective: 2.II

50) The disease anthrax is caused by the pathogenic bacterium _____, which produces heat-resistant structures known as _____.
A) *Azotobacter chroococcum* / endospores
B) *Azotobacter chroococcum* / plasmids
C) *Bacillus anthracis* / endospores
D) *Bacillus anthracis* / plasmids
Answer: C
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.8
Learning Objective: 2.II

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2.2 True/False Questions

1) In general, most cell inclusions function as energy reserves or as a reservoir of structural building blocks.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.7
Learning Objective: 2.II

2) In general, lipids in archaeal cytoplasmic membranes lack true fatty acids.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
Learning Objective: 2.I

3) Some membrane proteins are involved in bioenergetic reactions, while others are involved in membrane transport.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.2
Learning Objective: 2.I

4) Both hydrophilic and charged molecules readily diffuse through the cytoplasmic membrane.
Answer: FALSE
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Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
Learning Objective: 2.I

5) Teichoic acids are commonly found in gram-negative cell walls.
Answer: FALSE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.3
Learning Objective: 2.I

6) Despite the invariance of the backbone of peptidoglycan, there are more than 100 different types of peptidoglycan.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.3
Learning Objective: 2.I

7) Lysozyme is an enzyme that can ultimately lyse and kill eukaryotic cells by breaking β-1, 4-glycosidic bonds in peptidoglycan.
Answer: FALSE
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Chapter Section: 2.3
Learning Objective: 2.I

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8) Porins are channels in the outer membranes of gram-positive *Bacteria*.
Answer: FALSE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.4
Learning Objective: 2.I

9) In general, swimming is performed with flagella, whereas gliding uses other cellular components such as pili.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.6
Learning Objective: 2.II

10) Chemotaxis is a sensory response affecting the rotational direction of the flagellar motor.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.11
Learning Objective: 2.III

11) Photoreceptors are analogous to chemoreceptors in that they are both proteinaceous sensors.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.12
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Learning Objective: 2.III

12) Pathogenic bacteria that contain S-layers are protected against host defense mechanisms.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.5
Learning Objective: 2.I

13) Poly-β-hydroxybutyric acid (PHB) is a carbon- and energy-storing polymer.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.7
Learning Objective: 2.II

14) Mitochondria and chloroplasts have their own DNA and ribosomes, which supports the endosymbiotic hypothesis.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.14
Learning Objective: 2.IV

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15) Macromolecules resulting from lysosomal digestion are used in cellular biosynthesis and energy generation.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.15
Learning Objective: 2.IV

16) ATP-binding cassette transport systems have high substrate affinity and thus help microorganisms survive in low nutrient environments.
Answer: TRUE
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.2
Learning Objective: 2.I

2.3 Essay Questions

1) Describe the makeup of the phospholipid bilayer. Include molecular orientation and proteins as well.
Answer: The fatty acid components of the lipids in the cytoplasmic membrane are oriented toward each other, whereas the glycerol-phosphates point out toward the cytoplasm and external environment. Proteins can span the entire membrane (both layers) or be embedded in the phospholipids on either side of the membrane.
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
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Learning Objective: 2.I

2) Compare and contrast the chemical composition and structure of the cytoplasmic membranes found in *Bacteria* and *Archaea.* What is the advantage of the archaeal membranes in relationship to the types of environments archaea may inhabit?
Answer: Bacterial cytoplasmic membranes contain fatty acids with ester linkages that always form a phospholipid bilayer that is highly fluid. Archaeal cytoplasmic membranes contain glycerol ethers that are either diether or tetraethers. Glycerol diether molecules form a bilayer membrane and glycerol tetraether form a monolayer membrane. Both the ether linkages and the monolayer structure are more rigid than the bilayer ester-linked fatty acids and are more stable at high temperatures and pressures. Archaea tend to inhabit more extreme environments in terms of temperature, pressure, and salt, thus the more stable membrane components allow archaea to survive under these conditions.
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.1
Learning Objective: 2.I

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3) You are studying swimming motility in a pathogenic bacillus. You create mutations in random genes and then test which mutations effect swimming motility by looking at the mutant cells under the microscope. One of the mutant bacteria cannot swim anymore, but still rotates around in one spot when you watch them. Using electron microscopy, you discover that some parts of the flagella are still present in the cell wall, but no long flagella are visible. Which gene do you think is mutated (i.e., missing) and which motility-related parts are still present in this mutant?
Answer: The flagellar apparatus is put together in a particular order, first the MS ring, anchoring proteins, and the hook extend off of the cytoplasmic membrane. Flagellin proteins then pass through the narrow filament channel and cap proteins finally are put onto the end when roughly 20,000 flagellin have been assembled. Flagellar growth thus occurs after the assembly of the basal body, rings, and hook. The basal body provides the rotation and uses the proton motive force to rotate the basal body. From the information given above, one can infer that the basal body and hook can still rotate, but the flagellin proteins are missing or defective so that no long flagella can form. This would explain why the cells might still rotate in place, but not be able to move forward rapidly.
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.9
Learning Objective: 2.III

4) Describe the mechanisms by which certain prokaryotes glide. What are the ecological advantages of gliding motility?
Answer: Mechanisms will vary depending on the organism described, some of which include the involvement of proteins in the cytoplasmic membrane, slime extrusion, and type IV pili. Examples of advantages could include biofilm formation on a surface, increased pathogenesis or movement toward a different habitat with new resources.
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.10
Learning Objective: 2.III

5) What is the function of an endospore and how is an endospore formed?
Answer: The function of an endospore is to allow the cell to survive harsh conditions by going into a dormant state. An environmental trigger, such as nutrient depletion or dehydration triggers the formation of compounds such as SASP and dipicolinic acid to protect the DNA from damage and reduce the water content inside the endospore. These changes protect the DNA and other critical chemical components from heat, desiccation, and UV exposure. The function of an endospore is not for reproduction because every cell forms only one endospore. (The amount of detail expected in this answer should commensurate with the amount of detail discussed in class.)
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.8
Learning Objective: 2.II

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6) You have discovered a new bacterial strain that causes urinary tract infections. Closely related bacterial species cannot cause infections. You compare the strains and find that your new strain has structures composed of protein external to its cell wall. What structures might your new strain have that the other strains do not? Why?
Answer: Pili or fimbriae are the most likely structures that are found in the new pathogenic strain but missing in the nonpathogenic strains. Both pili and fimbriae aid in attachment of cells to surfaces and tissues. Attachment is important for pathogenesis. In addition, some pili are involved in twitching motility, which can help cells invade the body. (Other answers such as the capsule would only be partly correct, since the capsule is not made of protein. Flagella could also be an acceptable answer if they logically connect swimming motility to pathogenesis.)
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.6
Learning Objective: 2.II

7) Construct a chart to show at least five major differences between the cytoplasmic membrane and cell wall of bacteria and archaea. What are the implications of these differences?
Answer: Answers could include the following: the abundance or presence of amino acid stereoisomers, polysaccharides, pseudomurein and S-layers, action of lysozyme and penicillin, and type of glycosidic bonds.
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.1, 2.3
Learning Objective: 2.I

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8) Elaborate on why discovering endospores was important to microbiology.
Answer: Endospores allow bacteria to survive boiling water, UV light, and extreme desiccation, as well as allowing them to be in a dormant state for very long periods of time. Two possible themes could be how the discovery of endospores changed sterilization procedures for food and surgical instruments, as well as a change in our view of how bacteria can survive, such as surviving in space and surviving 1,000s of years in a dormant state.
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.8
Learning Objective: 2.II

9) Predict what would happen to a motile bacterium undergoing chemotaxis if the Mot proteins suddenly ceased to function.
Answer: The function of Mot proteins should be described producing the rotation of the flagella. This would probably allow flagella to form, but they would not be able to rotate. The bacterium would not be able to move, but the flagella would still look normal.
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.9
Learning Objective: 2.III

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10) Explain why a eukaryotic cell needs membrane-enclosed lysosomes and peroxisomes.
Answer: The structures both contain high concentrations of enzymes that serve as a localized region to perform specific reactions. Enclosed membranes provide a barrier to maintain conditions within the lysosomes and peroxisomes that are unlike those in the cytoplasm, which is important because environmental conditions for these processes to be optimal are often different than the conditions in the cytoplasm.
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.15
Learning Objective: 2.IV

11) Antibiotics such as penicillin interfere with the ability of bacteria to synthesize cell walls. Explain why cell walls are a good target for a useful antibiotic and whether you think that penicillin would be effective against a bacterial cell in an isotonic environment.
Answer: Because human cells do not use peptidoglycan, an antibiotic that affects peptidoglycan can harm bacterial cells with less risk of damage to human cells even though all medications may have some adverse effects (such as causing an allergic reaction). In an isotonic environment, a bacterial cell can survive without a cell wall and therefore penicillin would be less effective than in a hypotonic environment.
Bloom's Taxonomy: 5-6: Evaluating/Creating
Chapter Section: 2.3
Learning Objective: 2.I

12) How would the presence of endospores in Louis Pasteur's nutrient solutions have affected his conclusions about spontaneous generation?
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Answer: Answers will vary, but ultimately this could have confounded Pasteur if the endospores sometimes went into a vegetative growth phase and other times no growth was observed.
Bloom's Taxonomy: 3-4: Applying/Analyzing
Chapter Section: 2.8
Learning Objective: 2.II

13) Explain the differences between symporters and antiporters.
Answer: Answers should highlight differences in transport direction and energy input.
Bloom's Taxonomy: 1-2: Remembering/Understanding
Chapter Section: 2.1
Learning Objective: 2.I

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