CHAPTER 3 Cell Structure and Function

Multiple Choice

1. D	5. D	9. C	13. B	17. C
2. B	6. B	10. D	14. C	18. D
3. A	7. A	11. A	15. B	19. D
4. D	8. B	12. C	16. D	20. C

Fill in the Blanks

1. capsule, slime layer
2. flagellin, tubulin
3. N-acetylglucosamine (NAG), N-acetylmuramic acid (NAM)
4. Lipid A, LPS
5. hopanoids
6. Part a: moves into the cell; Part b: does not move; Part c: moves out of the cell, moves into the cell, moves out of the cell, moves into the cell, moves out of the cell
7. isotonic, out of, shrink
8. the same, different, active
9. smaller, 70, 30, 50
10. cellulose, chitin, glucomannan
11. cholesterol
12. microtubules, microfilaments, intermediate filaments
13. secretory vesicles, exocytosis
14. nucleus, mitochondria
15. mitochondria, chloroplasts

Matching

1. F	3. H	5. B	7. C	9. E
2. J	4. I	6. G	8. A	10. D

Short-Answer Questions for Thought and Review

1. Movement: flagellum (prokaryote only is shown), cilia (eukaryotic only); protection/adherence/interface with outside of cell: cell membrane, cell wall, glycocalyx; *control center*: nucleoid, nucleus (nuclear envelope, perinuclear space, nuclear pore, nucleolus); physical structure: cell wall, cytoskeleton; "mechanical operation of cell": cytoplasm, ribosomes, lysosomes, mitochondria, centriole, secretory vesicle, Golgi, transport vesicle, rough and smooth endoplasmic reticulum; storage: inclusions (prokaryotic only)
2. Bacteria use flagella to move by runs and tumbles. To move toward an attractant, runs must occur more frequently than tumbles and will be longer to get the organism moving in the general direction of the attractant.
3. Corkscrew motility is caused by the axial filament, a flagellum wrapped around the body of the microbe. It might help invasion because the corkscrew motion is one designed to embed something into a surface (think about a screw being turned into a piece of wood). The end of the microbe will contact the tissue surface and as it moves and works its way in, the corkscrew form will hold it in place.

4. Gram positive infections are "less damaging" because they do not produce an endotoxin. Thus, when the organisms die, there is no secondary toxic effect from the components of the cell wall being released into the host. In Gram negatives, when the cells die, LPS, containing lipid A, is released and causes immunological response damage.
5. Essentially, the diagram will look like part c of Figure 3.19. The movement of protons coupled to an ATPase provides the energy for the symport of glucose into the cell.
6. Since there are differences between prokaryotes and eukaryotes in terms of structure and function it makes sense to target the differences when using antimicrobial drugs. This way the drugs kill the bacteria and leave host tissues alone because they can't recognize or react with them.
7. The Gram positive cell wall presents a rigid barrier that does not allow the extrusion of cytoplasm to form pseudopodia; thus the cells can't phagocytize anything.

Critical Thinking

1. Metabolism is probably the most important determinant of life because it is the one thing that ensures independent survival. Organisms must be able to take in nutrients, process them, use them, excrete wastes, and repeat the process simply to maintain cohesion, function, etc. A chair cannot metabolize and cannot continue to "survive" unless someone takes care of it, polishes it, fixes it when it is broken. It does not cease to be a chair because it cannot communicate or respond to the environment.
2. Organelles allow for compartmentalization and a higher degree of organization within the eukaryotic cell than in the prokaryotic cell. Organization allows for more complexity because there is a way to regulate what is going on. Thus, organelles allow for the grouping of like functions, the linking of functions across the cell, and therefore the cells can afford to be larger and more complex.
3. Glucose 6-phosphate is physically and chemically different than glucose. Glucose, therefore, will be "high" outside the cell, but "low" (to nonexistent) inside the cell because it does not exist as glucose once it is translocated. Glucose will therefore continue to be drawn into the cell because the gradient will always be high to low (outside to inside).
4. You would look most for the remnants of metabolic processes that would indicate some ability to survive independently.

Concept Building Questions

1. The hydrophilic head groups will be held together by weak ionic bonds and some hydrogen bonds; the hydrophobic tails will associate hydrophobically (they exclude water; the carbon and hydrogen atoms themselves are held together by nonpolar covalent bonds). Since the only true bonding is occurring with the hydrophilic region, high temperatures, which increase movement and ultimately will disrupt noncovalent bonds, will have a tendency to unzip the bilayer (there are no bonds internally holding one side to the other). Thus, a single layer is far more stable because it can't "melt."
2. Leeuwenhoek was the first to describe bacteria, though he didn't know what they were. He would have been able to see inside eukaryotic cells, but

most likely not inside prokaryotes. He would have noticed a size difference, differences in overall shape, and depending on how he prepared his samples he might have been able to see flagella or capsules or other external structures. He would have been able to see some of the internal architecture of eukaryotic cells, most notably the nucleus, and may have been able to deduce that his wee "beasties," being so much smaller, probably didn't have one.