Name: _____________________ Lab Time: _______

The Cell
Study Guide, Chapter 2

Part I. Clinical Applications

1. Johnny lacerated his arm and rushed home to Mom so she could “fix it”. His mother poured hydrogen peroxide over the area, and it bubbled vigorously where it came in contact with the wound. Because you can expect that cells were ruptured in the injured area, what do you think was happening here?

    The oxidases of ruptured peroxisomes were converting the hydrogen peroxide to water and free oxygen gas (which causes the bubbling).

2. Your friend tells you that he is taking the antibiotic streptomycin for an infection. He wants to know how this particular antibiotic can kill bacterial cells but not kill his own cells. What is your explanation?

    Streptomycin inhibits bacterial protein synthesis by interfering with ribosomal function of bacteria and has no effect on the ribosomes of humans. If the bacterial are unable to synthesize new protein (many of which would be essential enzymes), they will die.

3. Sarah, a trainee of the electron microscopist at the local hospital is reviewing some micrographs of muscle cells and macrophages (phagocytic cells). She notices that the muscle cells are loaded with mitochondria while the macrophages have abundant lysosomes. Why is this so?

    Mitochondria are the site of most ATP synthesis, and muscle cells use tremendous amounts of ATP during contraction. After ingesting bacteria or other debris, phagocytes must digest them, explaining the abundant lysosomes.

4. In normally circulating blood, the plasma proteins cannot leave the blood stream easily and, thus, tend to remain in the blood. But if stasis (blood flow stoppage) occurs, the proteins will begin to leak out into the interstitial fluid. Explain why this leads to edema (water buildup in the tissues).

    Edema will occur because the filtration pressure exerted by the blood forces blood proteins into the interstitial space, and water follows down its concentration gradient by osmosis.

5. You over hear a group of teenagers betting each other as to who could drink the most water within a 30 minute time span. Being the excellent medical student that you are you interrupt them and explain the dangers of drinking seemingly harmless liquid (water) in such a short period of time. What is your explanation?

    Drinking water is hypotonic to the cells of you body. Taking in too much water in a short period of time will cause the blood and eventually the interstitial fluid to become hypotonic to the body cells. The extracellular water will then move by osmosis into the body cells and cause them to rupture. This could, and has in the past, kill a person.

6. Some pediatricians recommend the use of a 10% salt solution to relieve congestion for infants with stuffy noses. What effect would such a solution have on the cell lining the nasal cavity, and why?

    The 10% salt solution would be hypertonic with respect to the cells lining the nasal cavity, because this solution contains a higher concentration of salt than do the cells. The hypertonic solution would draw water out of the cells, causing the cells to shrink and adding water to the mucus, thus relieving the congestion.

7. An instructor at the fitness center tells you that bodybuilders have the potential for increased supplies of energy and improved muscular performance because of increased numbers of mitochondria in their muscle cells. Is this correct? Why or why not?

    Yes, it is correct. Mitochondria contain RNA, DNA, and enzymes needed to synthesize proteins. Mitochondria control their own maintenance, growth and reproduction. The muscle cells of bodybuilders have high rates of energy consumption and over time their mitochondria respond to increased energy demand by reproducing mitochondria.

8. One remedy for constipation is a saline laxative such as Epsom salts (MgSO4). Why do such salts have a laxative effect?

    Epsom salts increases the solute concentration in the lumen of the large intestine making the intestine hypertonic to surrounding tissues. The osmosis of water occurs from the surrounding tissues into the intestinal lumen. The fluid helps soften the stool and the watery environment prepares the intestine for eventual evacuation of the stool from the bowel.

9. In a hospital, a nurse gave a patient recovering from surgery a transfusion of 5% salt solution by mistake instead of a transfusion of physiological saline (0.9% salt). The patient quickly went into shock and soon after died. What caused the patient to enter into a state of shock and die?

    Because of the increase of solute concentration in the body fluid, it became hypertonic to the RBCs. The RBCs dehydrated and shrank – crenation. The crenated RBCs lost their oxygen-carrying capacity and the body tissues were deprived of the oxygen necessary of cellular metabolism to support life.

10. A smart student of anatomy was preparing a tossed salad in the afternoon for the evening meal. The vegetables to be used were placed in a bowl of cold water in order to keep these vegetables crisp. Osmotically speaking, explain why the vegetables remain crisp.

    The vegetables contain greater solute concentration than does the watery environment surrounding them. Since the watery environment is hypotonic to the cells of the vegetables, the osmosis of water into the vegetables causes crispness, or turgidity.

Part II

1. Glycoprotein
2. Integral protein
3. Cholesterol
4. Peripheral protein
5. Integral protein with pore
6. Simple diffusion
7. Filtration
8. Facilitated diffusion
9. Osmosis
10. low; high
11. ATP
12. Phagocytosis, Pinocytosis (bulk-phase), Receptor mediated endocytosis
13. Phagocytic vesicle
14. Receptor mediated endocytosis

Part III

1. Cell (plasma) membrane
2. Cytoplasm
3. Nuclear envelope (membrane)
4. Nucleolus
5. Nucleus
6. Lysosome
7. Centrosome
8. Centrioles
9. Microtubule network
10. Microvilli
11. Cilia
12. Secretory vesicles
13. Golgi apparatus (body)
14. Smooth endoplasmic reticulum (SER)

A. Mitochondria
B. Ribosome (attached to RER)
C. Free ribosome
D. rough endoplasmic reticulum (RER)

15. F
16. T
17. F
18. F
19. T
20. F
21. mitosis, somatic cell division
22. meiosis, reproductive division
23. cytokinesis
24. anaphase
25. prophase
26. metaphase
27. telophase
28. leukemia
29. sarcoma
30. lymphoma
31. osteogenic sarcoma
32. melanoma
33. carcinoma
34. neoplasm; malignant; benign
35. malignant; metastasis
36. meiosis; mitosis
37. cytokinesis; mitosis

Part IV

1. RER
2. SER
3. SER
4. golgi complex
5. lysosome
6. mitochondria
7. microfilaments
8. microtubules
9. centrioles
10. flagella
11. cilia
12. SER
13. mitochondria
14. cilia
15. golgi
16. lysosomes
17. simple diffusion
18. facilitated diffusion
19. osmosis
20. pinocytosis (bulk-phase endocytosis)
21. phagocytosis
22. exocytosis
23. D
24. B
25. more; fewer
26. A
27. out of; crenate
28. Iso
29. Isotonic; Hypotonic to Isotonic (depending on severity). An isotonic solution is 0.9% NaCl or 5% glucose. A hypotonic solution will be less.
30. C
31. A

Part V

1. Exocytosis, phagocytosis, pinocytosis, receptor-mediated endocytosis
2. simple diffusion, osmosis, facilitated diffusion
3. filtration
4. simple diffusion, osmosis, facilitated diffusion
5. active transport
6. simple diffusion
7. active transport
8. exocytosis, phagocytosis, pinocytosis, receptor-mediated endocytosis
9. phagocytosis
10. exocytosis
11. facilitated diffusion
12. Somatic cells
13. G1
14. G2
15. Mitosis
16. DNA Replication
17. Metaphase
18. Telophase
19. cytokinesis
20. chromatin
21. chromatids
22. centromeres
23. centrosomes or centrioles
24. prophase
25. anaphase
26. telophase
27. telophase
28. metaphase
29. prophase
30. prophase
31. S
32. prophase
33. Prophase
34. telophase/cytokinesis
35. anaphase; metaphase
36. Go
37. C
38. B
39. B
40. A
41. C
42. A

Part VI

1. extracellular fluid
2. cilia
3. cell membrane
4. integral proteins
5. channels
6. phospholipid
7. peripheral proteins
8. intracellular fluid
9. ions
10. proteins
11. cytoskeleton
12. organelles
13. cytosol
14. nonmembranous
15. protein synthesis
16. cell division
17. mitochondria
18. cristae
19. matrix
20. respiratory enzymes
21. ATP
22. nucleus
23. nuclear envelope
24. nuclear pores
25. nucleoli
26. ribosomes
27. nucleoplasm
28. chromosomes
29. endoplasmic reticulum
30. rough endoplasmic reticulum
31. golgi apparatus
32. saccules

Extra Credit Questions

1. In kidney dialysis, a person's blood is passed through a bath that contains several ions and molecules. The blood is separated from the dialysis fluid by a membrane that allows water, small ions, and small molecules to pass, but does not allow large proteins or blood cells to pass. What should the composition of dialysis fluid be for it to remove urea (a small molecule) without changing the blood volume (removing water from the blood)?

    For the dialysis fluid to remove urea, it should not contain urea. Because urea is a small molecule, it will diffuse through the dialysis membrane from an area of high concentration (the blood) to an area of low concentration (the dialysis fluid). To prevent associated water movement, the dialysis fluid should have an osmotic concentration similar to that of blood plasma by with higher concentrations of solutes such as bicarbonate ions or glucose. As urea diffused into the dialysis fluid, glucose and bicarbonate diffuse into the blood. As a result, the solute concentrations remain in balance and no osmotic water movement occurs.

2. B
3. D
4. A
5. D
6. C