Name: _____ **AP Biology**

Chapter 5 Active Reading Guide
Membrane Transport and Cell Signaling

Section 1

1. Phospholipids are *amphipathic.* Explain what this means.

2. In the 1960s, the *Davson-Danielli model* of membrane structure was widely accepted. Describe this model and then cite two lines of evidence that were inconsistent with it.

3. The currently accepted model of the membrane is the *fluid mosaic model.* Who proposed it? When? Describe this model.

4. What is meant by *membrane fluidity*? Describe the movements seen in the fluid membrane.

5. Describe how each of the following can affect membrane fluidity:
   a. decreasing temperature:

   b. phospholipids with unsaturated hydrocarbon chains:

   c. cholesterol:

6. Membrane proteins are the *mosaic* part of the model. Describe each of the two main categories:
integral proteins:

peripheral proteins:

7. Study Figure 5.7 in your text. Use it to briefly describe the following major functions of membrane proteins.

Function	Description
Transport	
Enzymatic Activity	
Attachment to the Cytoskeleton and ECM	
Cell-Cell Recognition	
Intercellular Joining	
Signal Transduction	

8. Membrane carbohydrates are important in cell-cell recognition. What are two examples of this?

9. Distinguish between *glycolipids* and *glycoproteins*.
Glycolipids:

Glycoproteins:

Section 2

10. Distinguish between *channel proteins* and *carrier proteins*.

11. Are transport proteins specific? Cite an example that supports your response.

12. Peter Agre received the Nobel Prize in 2003 for the discovery of *aquaporins*. What are they?

13. Consider the following materials that must cross the membrane. For each, tell how it is moved across.

Material	Method
CO_2	
Glucose	
H^+	
O_2	
H_2O	

Section 3

15. Define the following terms:

Term	Definition
Diffusion	
Concentration Gradient	
Passive Transport	
Osmosis	
Isotonic	
Hypertonic	
Hypotonic	
Turgid	
Flaccid	
Plasmolysis	

16. What is *facilitated diffusion*? Is it active or passive? Cite two examples.

17. Why does the red blood cell burst when placed in a hypotonic solution, but not the plant cell?

Section 4

18. Describe *active transport*. What type of transport proteins are involved, and what is the role of ATP in the process?

19. The *sodium-potassium pump* is an important system for you to know. Use Figure 5.14 to understand how it works, and briefly summarize what is occurring in each step.

20. For each type of transport, give an example of a material that is moved in this manner.

Method	**Material**
Facilitated Diffusion with a Carrier Protein	
Facilitated Diffusion with a Channel Protein	
Active Transport with a Carrier Protein	
Simple Diffusion	

21. What is *membrane potential*? Which side of the membrane is positive?

22. What are the two forces that drive the diffusion of ions across the membrane? What is the combination of these forces called?

23. What is *cotransport*? Explain how understanding it is used in our treatment of diarrhea.

Section 5

24. Define each of the following, and give a specific cellular example.

Term	Definition	Example
Exocytosis		
Endocytosis		
Receptor-Mediated Endocytosis		
Phagocytosis		
Pinocytosis		

25. What is a *ligand*? What do ligands have to do with receptor-mediated endocytosis?

26. Are the processes you described in question 21 active or passive transport? Explain your response.

Section 6

Chapter 5 – Section 6 is one of the most difficult sections in the book. The special challenge in this section is not that the material is so difficult, but that most of the material will be completely new to you. Cell communication is normally not covered in standard high school biology books, yet perhaps no other section of biology has grown as much as cell signaling in the last ten years. Take your time with this section, and you will be rewarded with a knowledge base that will be most helpful in this course and courses to come.

27. What is a *signal transduction pathway*?

28. Complete the chart of local chemical signaling in cell communication in animals.

Term	Description	Specific Example
Paracrine signaling		
Synaptic signaling		

29. How does a hormone qualify as a *long-distance signaling* example?

30. A signal transduction pathway has three stages. Use Figure 5.20 to explain each step.
    a. **reception**:

b. **transduction**:

c. **response**:

31. Explain the term *ligand*. (This term is not restricted to cell signaling. You will see it in other situations during the year.)

32. Describe the role of the three components of a *G protein-coupled receptor*.
    a. **G protein-coupled receptor**:

    b. **G protein**:

    c. **GDP**:

33. Equally important to starting a signal is stopping a signal. (Failure to do so can lead to serious problems, like cancer.) Describe how the signal is halted.

34. What activates a G protein? _____

35. A G protein is also a GTPase enzyme. Why is this important?

36. Look next at *ion channel receptors*. This figure shows the flow of ions into the cell. Ion channel receptors can also stop the flow of ions. These comparatively simple membrane receptors are explained in three steps. Explain the role of the following molecules.
    a. **ligand**:

b. **ligand-gated ion channel receptor**:

c. **ions**:

37. Figure 5.22 shows what has happened with the binding of the ligand to the receptor. Explain what occurs.

38. The ligand attachment to the receptor is brief. Explain what happens as the ligand dissociates.

39. In what body system are *ligand-gated ion channels* and *voltage-gated ion channels* of particular importance?

40. Intracellular receptors are found either in the cytoplasm or nucleus of target cells. In order to be able to pass through the plasma membrane, the chemical messengers are either hydrophobic or very small, like nitric oxide. Referring to Figure 5.23, explain how testosterone, a hydrophobic steroid hormone, works as an intracellular receptor.

41. What are two benefits of multistep pathways like the one in Figure 5.23 in your book?

42. Explain the role in transduction of these two categories of enzymes.
protein kinase:

protein phosphatases:

43. What is the difference between a first messenger and a second messenger?

44. Two common *second messengers* are *cyclic AMP* (*cAMP*) and *calcium ions* (Ca^{2+}). Explain the role of the second messenger cAMP in Figure 5.25 in the text.

45. What is the important relationship between the second messenger and *protein kinase A*?

46. Figure 5.25 explains a cellular response is initiated; how might that response be inhibited?

47. Use your new knowledge of cell signaling to explain the mechanism of disease in cholera.

48. When cell signaling causes a nuclear response, what normally happens?

49. When cell signaling causes a cytoplasmic response, what normally happens?