Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ AP Biology Mrs. Javon

Chapter 5 Active Reading Guide: Membrane Transport and Cell Signaling

# Section 1

1. Phospholipids are *amphipathic.* Explain what this means.
2. The currently accepted model of the membrane is the *fluid mosaic model.* Describe this model.
3. What is meant by membrane fluidity? Describe the movements seen in the fluid membrane.
4. Describe how each of the following can affect membrane fluidity:
   1. decreasing temperature:
   2. phospholipids with unsaturated hydrocarbon chains:
   3. cholesterol:
5. Membrane proteins are the *mosaic* part of the model. Describe each of the two main categories:

## integral proteins:

## peripheral proteins:

1. 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** |  |

1. Membrane carbohydrates are important in cell-cell recognition. What are two examples of this?
2. Distinguish between *glycolipids* and *glycoproteins*.

**Section 2**

1. Distinguish between *channel proteins* and *carrier proteins*.
2. Are transport proteins specific? Cite an example that supports your response.
3. Peter Agre received the Nobel Prize in 2003 for the discovery of *aquaporins*. What are they?
4. Consider the following materials that must cross the membrane. For each, tell how it is moved across.

|  |  |
| --- | --- |
| **Material** | **Method** |
| **CO2** |  |
| **Glucose** |  |
| **H+** |  |
| **O2** |  |
| **H2O** |  |

# Section 3

1. Define the following terms:

|  |  |
| --- | --- |
| **Term** | **Definition** |
| **Diffusion** |  |
| **Concentration Gradient** |  |
| **Passive Transport** |  |
| **Osmosis** |  |
| **Isotonic environment** |  |
| **Hypertonic environment** |  |
| **Hypotonic environment** |  |
| **Turgid** |  |
| **Flaccid** |  |
| **Plasmolysis** |  |

1. What is *facilitated diffusion*? Is it active or passive? Cite two examples.
2. Why does the red blood cell burst when placed in a hypotonic solution, but not the plant cell?

# Section 4

1. Describe *active transport*. What type of transport proteins are involved, and what is the role of ATP in the process?
2. 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.

1. 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** |  |

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

1. What are the two forces that drive the diffusion of ions across the membrane? What is the combination of these forces called?
2. What is *cotransport*? Explain how understanding it is used in our treatment of diarrhea.

# Section 5

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

|  |  |  |
| --- | --- | --- |
| **Term** | **Definition** | **Example** |
| **Exocytosis** |  |  |
| **Endocytosis** |  |  |
| **Receptor- Mediated Endocytosis** |  |  |
| **Phagocytosis** |  |  |
| **Pinocytosis** |  |  |

1. 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.

1. What is a *signal transduction pathway*?
2. Complete the chart of local chemical signaling in cell communication in animals.

|  |  |
| --- | --- |
| **Term** | **Specific Example** |
| **Paracrine signaling** |  |
| **Synaptic signaling** |  |

1. How does a hormone qualify as a *long-distance signaling* example?
2. A signal transduction pathway has three stages. Use Figure 5.20 to explain each step.

## reception:

* 1. **transduction**:
  2. **response**:

1. Explain the term *ligand*. (This term is not restricted to cell signaling. You will see it in other situations during the year.)
2. Describe the role of the three components of a *G protein-coupled receptor*.

## G protein-coupled receptor:

1. **G protein**:
2. **GTP**:
3. What activates a G protein?
4. Look next at *ion channel receptors*. Figure 5.22 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.

## ligand:

1. **ligand-gated ion channel receptor**:
2. **ions**:
3. The ligand attachment to the receptor is brief. Explain what happens as the ligand dissociates.
4. In what body system are *ligand-gated ion channels* and *voltage-gated ion channels*

of particular importance?

1. 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 aldosterone, a hydrophobic steroid hormone, works as an intracellular receptor.
2. What are two benefits of multistep pathways like the one in Figure 5.23 in your book?
3. Explain the role in transduction of these two categories of enzymes.

## protein kinase:

**protein phosphatases**:

1. What is the difference between a first messenger and a second messenger?
2. Two common *second messengers* are *cyclic AMP* (*cAMP*) and *calcium ions* (Ca2+). Explain the role of the second messenger cAMP in Figure 5.25 in the text.
3. What is the important relationship between the second messenger and *protein kinase A*?
4. Figure 5.25 explains a cellular response is initiated; how might that response be inhibited?
5. When cell signaling causes a nuclear response, what normally happens?
6. When cell signaling causes a cytoplasmic response, what normally happens?