Name _____ Course/Section _____

Date _____ Professor/TA _____

Activity 7.2 How is the structure of a cell membrane related to its function?

Membranes compartmentalize the different functions of living cells. The cell membrane is a barrier between the cell or organism and its environment. Similarly, within the cell, membranes of organelles separate the different reactions of metabolism from each other.

Use the supplies provided in class or devise your own at home to develop a model of a cell membrane. Developing models of systems can help you understand not only their overall structure but also their function(s).

Building the Model

- Include in the membrane the phospholipid bilayer (phosphate heads and fatty acid tails) as well as the integral proteins.
- Design integral proteins that serve the functions of facilitated diffusion and active transport.
- Indicate how the various types of integral proteins might differ in structure and operation.

Use the understanding you gain from your model to answer the questions on the next pages.

1. Substances can move across the membrane via simple diffusion, facilitated diffusion, or active transport.

	a. Where does it occur in membrane?	b. Does it require transport protein?	c. Does it require input of energy?
Simple diffusion			
Facilitated diffusion			
Active transport			

d. What functions might each of the three types of diffusion serve in an independent cell like a *Paramecium* or an amoeba?

e. What functions might each of the three types of diffusion serve in a multicellular organism—for example, a human or a tree?

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2. What would you need to observe or measure to determine whether a substance was moved across a membrane via each type of diffusion?

Simple diffusion	Facilitated diffusion	Active transport

3. The ratios of saturated to unsaturated phospholipids in an organism's membranes can change in response to changes in environmental conditions.

a. How do the properties of a membrane that contains a low percentage of unsaturated phospholipids compare with those of a membrane that contains a high percentage of unsaturated phospholipids?

b. Considering what you know about the properties of saturated and unsaturated fatty acids, would you expect an amoeba that lives in a pond in a cold northern climate to have a higher or lower percentage of saturated fatty acids in its membranes during the summer as compared to the winter? Explain your answer.

4. A fish is removed from a contaminated lake. You determine that a particular toxin is present in its cells at concentration A (level A). You place the fish in a tank full of clean water, and several days later you measure the toxin concentration in the cells (level B).

a. You hypothesize that the toxin is strictly fat-soluble—that is, not water-soluble. If this hypothesis is valid, what relationship would you expect to see when you compare the toxin levels in the fish before (level A) and after (level B) several days in the tank: level A > level B, level B > level A, or level A = level B?

b. After making your hypothesis, you test it by measuring the toxin levels in the fish at various times during its several days in the tank. You observe that the level of toxin drops in the fish from concentration A to concentration B and then stabilizes at B. You test the water in the tank and find that after it stabilizes, toxin is present in the water at concentration B also. Which of the following processes is most likely eliminating the toxin from the fish?

i. Passive transport
ii. First active, then passive transport
iii. First passive, then active transport
iv. Active transport

c. Given the situation in part b, what should you do, in the short term, to reduce the toxin level in the fish below level B?

i. Add another fish to the tank.
ii. Add ATP to the tank.
iii. Add salt to the tank.
iv. Change the water in the tank.
v. Call the EPA (Environmental Protection Agency).

5. A particular amino acid is transported from the extracellular medium against its concentration gradient. The integral membrane protein that transports the amino acid also binds and transports Na^+. Using your model of the cell membrane, develop a transport mechanism that will permit the amino acid uptake to be coupled to the Na^+ transport so that the amino acid's entry is linked only indirectly to ATP hydrolysis.