

Biological membranes

Audience: Students entering University and early University students.

Duration: 15-20 minutes split into two aspects: Demonstration and reflection



Question: How do biological membranes control what enters and exits cells?

Prediction: Without looking below, what are some possible ways that you can think of that would allow molecules and/or ions to pass in and out of a cell's plasma membrane?

Observe:

Have a look at the diagram of the phospholipid bilayer of the cell membrane(right). Note that there is both hydrophobic and hydrophilic regions. Can you think of any ways molecules or ions could pass through?

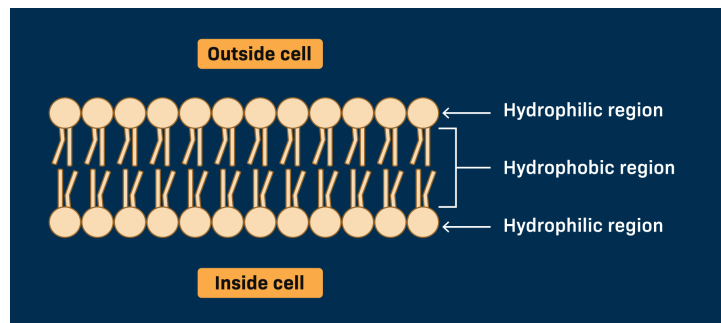


Figure 1. The phospholipid bilayer of a eukaryotic cell.

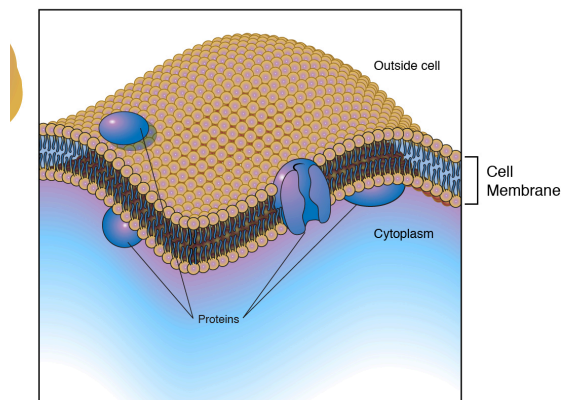


Figure 2. The phospholipid bilayer of a eukaryotic cell with protein channel.

Now look at the more realistic diagram of the plasma membrane(left). Think back to the question above, can you think of possible ways molecules and ions can pass through?

With what you have interpreted above, can you think of how molecules/ions might be able to pass through? What about LARGE molecules/ions?

After looking at the previous images, and your prior thought processes involved, analyze the next image.

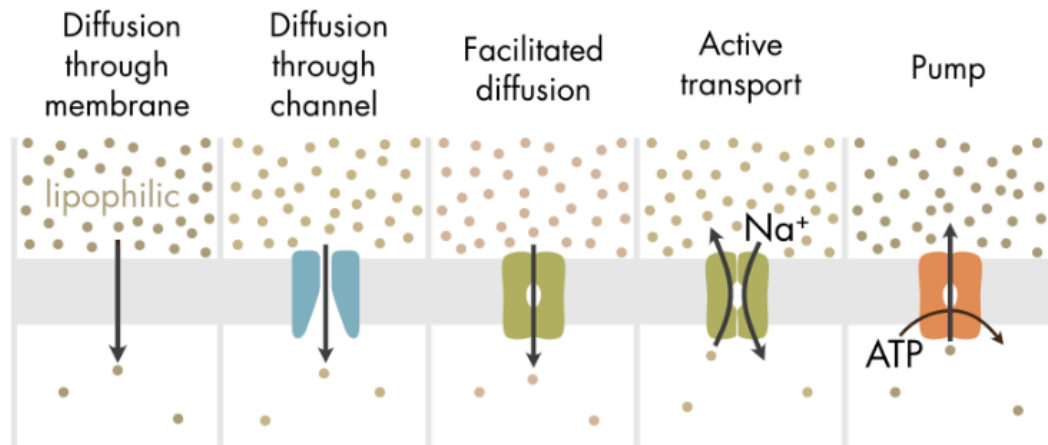


Figure 3. The processes involved with molecule and ion transport across the plasma membrane of a eukaryotic cell.

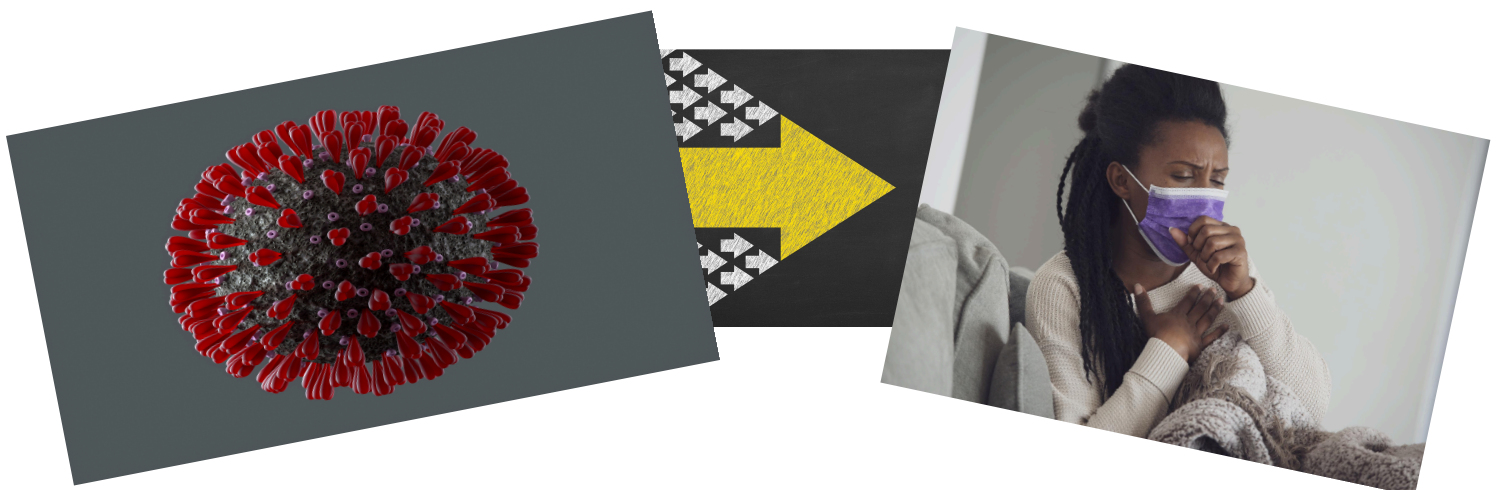
Think about the processes above, diffusion, Active transport, and pump, more specifically ion pumps. Can you think of any fallbacks or an ion pump?

Can you now answer the questions you have been asked?

1. what are some possible ways that you can think of that would allow molecules and/or ions to pass in and out of a cell's plasma membrane?
2. What about LARGE molecules/ions?
3. Can you think of any fallbacks or an ion pump?

If you are unsure, look at the images again and try and write down some possibilities. While you are thinking, think of energy requirements.

Deeper Thinking: With your interpretations, What may be some factors that could cause a cell to accidentally let in a virus or other harmful organisms?



Instructor guide:

Purpose: This activity is designed to make a student analyze figure accurately and develop scientific questioning and reasoning. Thus, further understanding of the information illustrated in scientific textbooks and articles.

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Materials need: N/A

Facilitation notes: Have students observe the inquiry question first. Then, observe each of the two first images in chronological order with attached script. Next, have them read and interpret the large ion question and write down a few ideas/possibilities. After thinking through and writing down some possible ideas, move onto the third image. Have them answer think about the follow up question. Lastly, have them revisit the 3 main questions and provide insightful answers. If they cannot answer either question, have them revisit the images and try and work through them again.

Expected answer key:

1. Diffusion, channels and pumps of some variation.
2. Being large, diffusion likely would not work and would require a channel or pump
3. Pumps require energy, and energy is expensive and crucial to the cell, therefore using energy is less efficient.

Accessibility: Use large and clear fonts, large images that are easy to see, like on a projector, oral responses would be beneficial for class discussions.

SDG 4 Connection: This activity provides processes that aid in reasoning with evidence and interpretation of scientific images and diagrams. By doing so, students will be able to visualize processes rather than written text only. Thus, making science more accessible to those that struggle understanding scientific jargon when presented in words. As well,, by working through each image, the process is learned, rather than memorized.

References:

1. McKinnon, D. [Membrane Transport]. Cellular Neurophysiology.
https://neurotext.library.stonybrook.edu/C1/C1_5/C1_5.html
2. National Human Genome Research Institute. Cell membrane (plasma membrane).
<https://www.genome.gov/genetics-glossary/Cell-Membrane-Plasma-Membrane>
3. LabXchange. [Introduction To Selective Permeable Membranes].
<https://www.labxchange.org/library/items/lb:LabXchange:60590310:html:1>