

# Week 4

## BIO-1305 - Biology 1 – Campbell Textbook

Hello and welcome to the weekly resources for BIO-1305 - Biology 1 – Campbell Textbook!

This week is Week 4 of class, and typically in this week of the semester, your professors are covering the topics below. If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout the semester.

We also invite you to look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester.

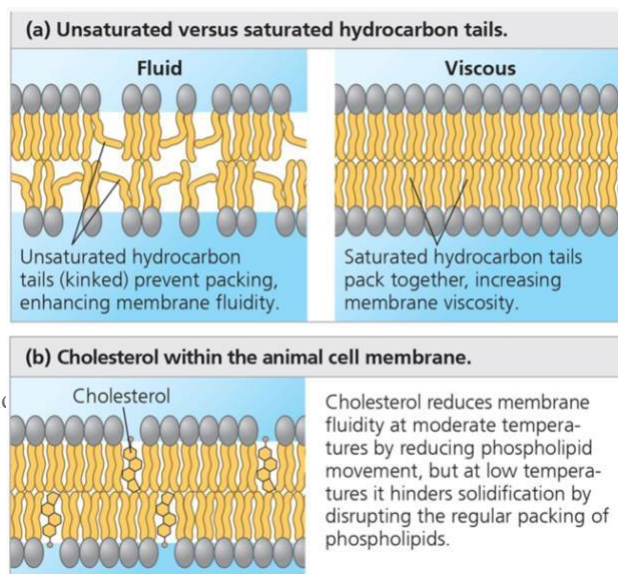
If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel, or any tutoring services we offer, please visit our website [www.baylor.edu/tutoring](http://www.baylor.edu/tutoring) or call our drop in center during open business hours (M-Th 9am-8pm on class days at 254-710-4135).

**Keywords: Organelles, Membrane Structure, Membrane Transport, Endosymbiotic Theory**

### Topic of the Week: Membrane Structure and Function

The cell membrane is a very important structure! It's quite literally what makes us stay together. The membrane is very *complex*. The basic structure consists of a **phospholipid bilayer**. Take a look at the previous resource for more information on *phospholipids*! It is often referred to as a **fluid mosaic model** because of the way protein molecules *drift* throughout the bilayer of phospholipids. The proteins that shift through the membrane have *specific, important functions*.

Membranes are extremely fluid. This is the “**fluid**” portion of the **fluid mosaic model**. Membrane fluidity is affected by **temperature** and the **type of phospholipids** that make up the membrane! *Cholesterol* also plays an important role in moderating membrane fluidity:



All diagrams, tables, and

ology 12<sup>th</sup> edition, unless

## Membrane Proteins

We've talked about the "fluid" part, so now let's talk about the "mosaic" part of the **fluid mosaic model**. The membrane contains many different proteins embedded in the bilayer. Different cells have different types of proteins that *perform specific functions!*

Here are the **main types of proteins** found in membranes:

- **Integral proteins:** transmembrane protein with *hydrophobic regions* extending into the interior of the membrane. Have *hydrophilic regions* in contact with aqueous solutions on one or both sides of the membrane
- **Transmembrane proteins:** *type of integral membrane protein* that **spans** the whole membrane
- **Peripheral proteins:** *loosely bound* to the surface of the membrane or to another protein. **Not embedded** in the membrane bilayer.

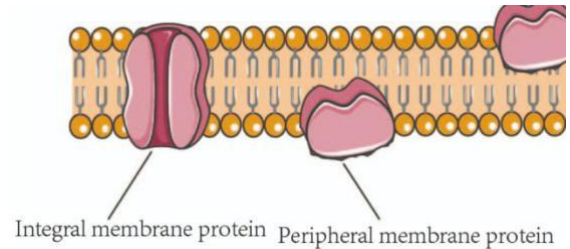


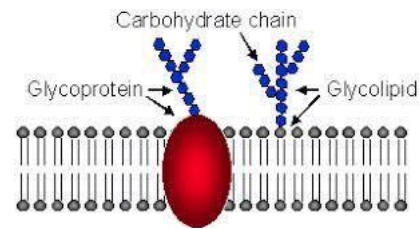
Photo taken from: <https://www.creative-biolabs.com/blog/index.php/membrane-protein-overview/>

These proteins all have **various functions** that fall under these six categories:

- Transport
- Enzymatic activity
- Signal transduction
- Cell-cell recognition
- Intercellular joining
- Attachment to cytoskeleton or extracellular matrix

**Carbohydrates** also play an important role in membrane function! They specifically play a part in *cell-cell recognition*. Two important types of carbohydrates involved in membranes are:

- **Glycolipids:** carbohydrates covalently bonded to *lipid molecules*
- **Glycoproteins:** carbohydrates covalently bonded to *proteins*



An important feature of membranes is their ability to be **selectively permeable**. This means that *only some substances* are allowed to cross the membrane. Cells can *regulate* what is allowed to cross the membrane!

- Molecules that can **easily cross** the membrane are those that are *hydrophobic and nonpolar*.
- Molecules that **cannot easily cross** the membrane and need an alternative method of entering are those that are *polar or hydrophilic*. Proteins in the membrane can help move these molecules across. These are called **transport proteins**.

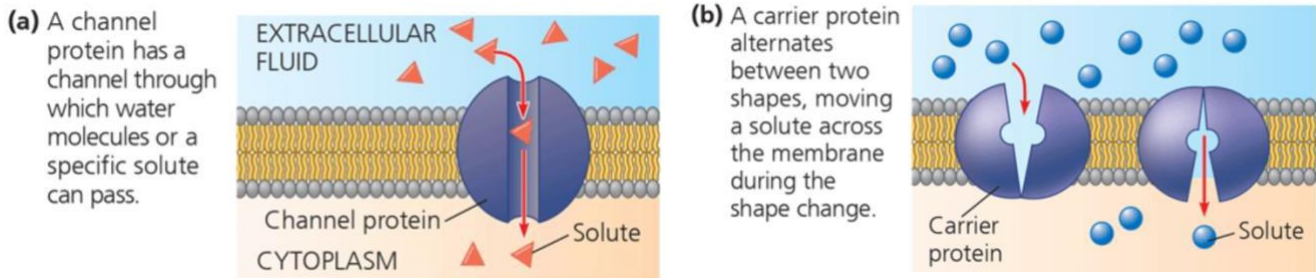
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## Highlight #1: Membrane Transport

There are two types of **membrane transport**: *passive* transport and *active* transport

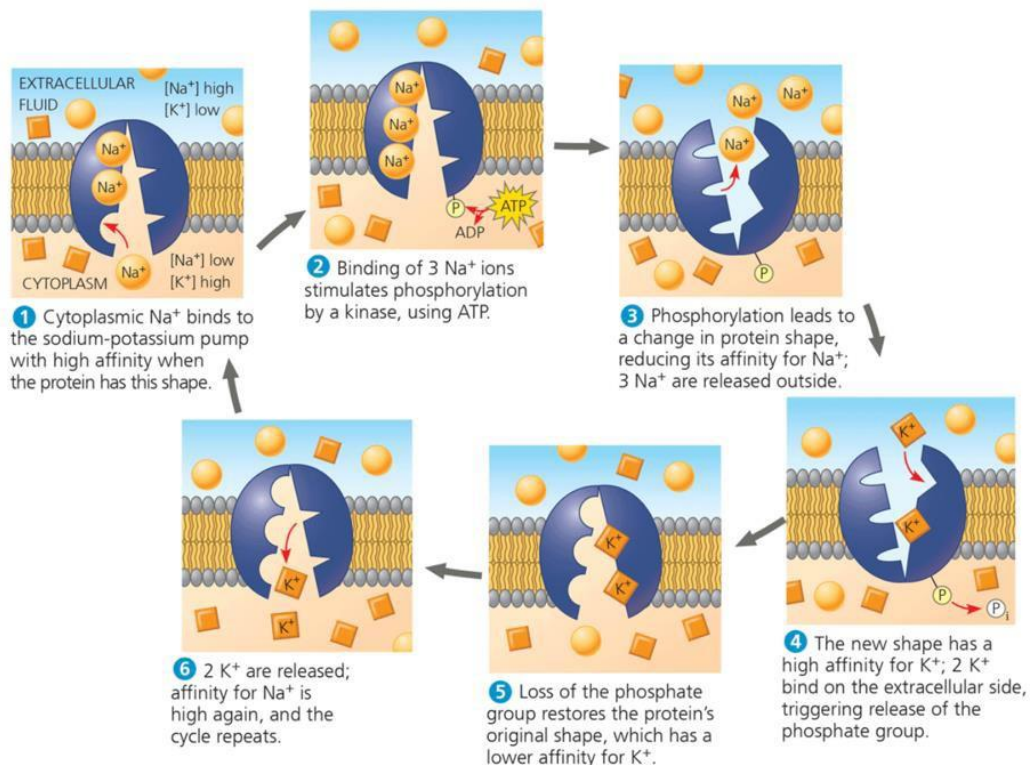
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- **Passive transport:** the diffusion of a substance across the membrane without input of energy
  - o **Facilitated diffusion** is a type of passive transport. This transport is aided by proteins and assists molecules and substances that cannot cross the membrane easily. *Channel proteins and carrier proteins* are the primary proteins that work in facilitated diffusion.



- **Active transport:** movement of a substance across a membrane *against its concentration or electrochemical gradient*, mediated by specific transport proteins. Requires the use of energy!

One important example of this is the **sodium-potassium pump**. This transport system moves **Na<sup>+</sup>** and **K<sup>+</sup>** across the membrane of cells



A few other important types of membrane transport are:

1. **Cotransport:** coupling of the *downhill diffusion* of one substance to the *uphill transport* of another against its concentration gradient. The diffusion provides the energy for the active transport of another substance!
2. **Exocytosis:** secretion of molecules by fusion of vesicles with the plasma membrane
3. **Endocytosis:** uptake of molecules by formation of vesicles from the plasma membrane  
Types: **phagocytosis** (cell “eating”), **pinocytosis** (cell “drinking”), and **receptor-mediated endocytosis**

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### Highlight #2: Organelles

Cells are the basic units of life. There are two types: **prokaryotic and eukaryotic**. Major differences between prokaryotic and eukaryotic cells:

Prokaryotic Cells	Eukaryotic Cells
Very minute in size	Fairly large in size
Nuclear region (nucleoid) not surrounded by a nuclear membrane	Nuclear material surrounded by a nuclear membrane
Single chromosome present	More than one chromosome present
Nucleolus absent	Nucleolus present
Membrane bound cell organelles are absent	Membrane bound cell organelles are present
Cell division by fission or budding (no mitosis)	Cell division by mitosis or meiosis

Photo taken from:  
<https://ccyangyan.wordpress.com/2012/02/23/the-table-about-difference-between-prokaryotic-and-eukaryotic-cells/>

This chapter dives right into the **structures and functions of cells!** It’s important to realize how complex cells are. Each structure plays an important role, but each role falls under one of these three categories:

1. Energy and matter transformations
2. Interactions with the environment
3. Genetic information storage and transmission

There are great picture/diagrams in your Campbell biology book about the different organelles and their functions, but you can click on these videos for a review of most of what you should be familiar with:

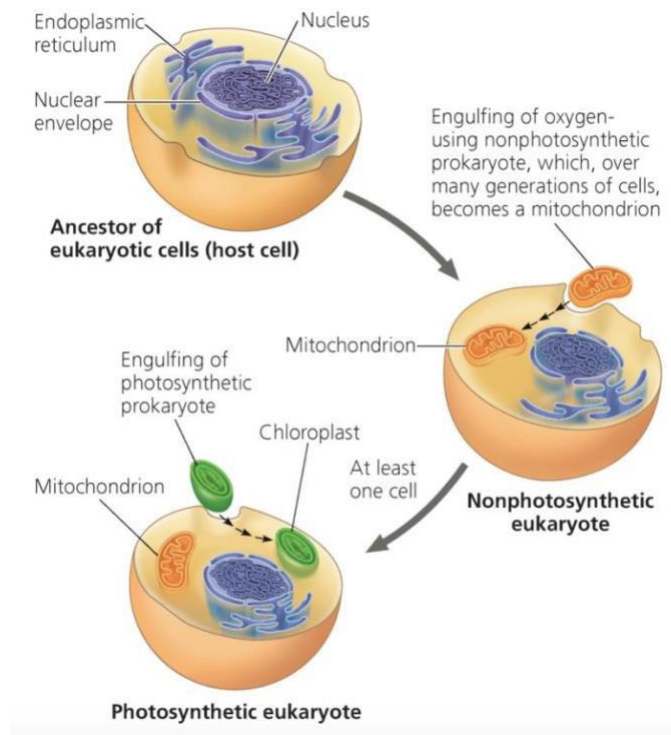
**[The Nucleus](#), **[Ribosomes](#), **[Endomembrane System](#), **[Mitochondria](#), **[Chloroplasts](#), **[Peroxisomes](#), **[The Cytoskeleton](#), **[The Extracellular Matrix](#), **[Cell Junctions](#)******************

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### Highlight #3: The Endosymbiotic Theory

An important topic in cell biology is the **endosymbiotic theory**. This idea explains how mitochondria and chloroplasts came to be part of eukaryotic cells, and can be explained by this photo:

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### CHECK YOUR LEARNING

1. What types of molecules can pass through the membrane easily?
2. What are the three main types of membrane proteins?
3. Which types of membrane transport require energy?

### THINGS YOU MAY STRUGGLE WITH

1. The terms involved with passive and active transport can sometimes be confusing. It is important to remember that facilitated diffusion is still PASSIVE transport. Just because it is using a protein for assistance doesn't mean it requires energy!
2. The sodium-potassium pump is a source of confusion for many students. A helpful tip for remembering what is pumped in and out is: "pumpkin" – pump K<sup>+</sup> in. You can use this to remember that potassium is pumped into the cell and Na<sup>+</sup> is pumped out.

Thanks for checking out these weekly resources!

Don't forget to check out our website for group tutoring times, video tutorials and lots of other resources: [www.baylor.edu/tutoring](http://www.baylor.edu/tutoring)! Answers to *Check your Learning* questions are below!

Answers:

1. Hydrophobic, small, nonpolar molecules
2. Integral, transmembrane, and peripheral
3. Active transport requires energy

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