# Do smaller or larger molecules diffuse faster?

**A:**

### **QUICK ANSWER**

Smaller molecules diffuse faster than larger molecules. The smaller molecules are able to move more quickly at a given temperature than larger molecules, allowing them diffuse across the membrane with greater speed.

[**CONTINUE READING**](https://www.reference.com/science/smaller-larger-molecules-diffuse-faster-7faf96fc8daa843)

## **KEEP LEARNING**

## [Which formula represents a nonpolar molecule?](https://www.reference.com/science/formula-represents-nonpolar-molecule-30fbcdc503fcbcce)

## [What are the bonds that are broken when water vaporizes?](https://www.reference.com/science/bonds-broken-water-vaporizes-58431db29fa073d4)

## [What is the difference between atoms and molecules?](https://www.reference.com/science/difference-between-atoms-molecules-a6c34647cd108cb0)

### **FULL ANSWER**

The size of a molecule is not the only factor that can influence the rate of diffusion. Molecules diffuse faster as temperature increases. Molecules also diffuse across a membrane with greater speed as the difference of the concentrations on both sides of the membrane increases. Molecules diffuse quickly across larger surface areas and move more slowly at greater distances. Some membranes can be more permeable than others, increasing the rate of diffusion.

When molecules are released into an environment, they tend to spread out to less concentrated areas. This process is called diffusion. Diffusion is used to move molecules both in and out of a cell. It is a type of passive transport that does not require the cell to expend energy. Channels exist in the cell membrane that allow some molecules to diffuse, while other molecules are allowed passage in and out of the cell through special carrier proteins.

Osmosis is the diffusion of water. Water moves freely across the cell membrane, equalizing concentrations on both sides of the membrane when other particles are unable to diffuse.

# **Cholesterol is Abundant in Cell Membranes**

Cholesterol is found in every cell of your body. It is especially abundant in the membranes of these cells, where it helps maintain the integrity of these membranes, and plays a role in facilitating cell signaling-- meaning the ability of your cells to communicate with each other so you function as a human, rather than a pile of cells.

Molecule for molecule, cholesterol can make up nearly half of the cell membrane.1 Since it is smaller and weighs less than other molecules in the cell membrane, it makes up a lesser proportion of the cell membrane's mass, usually roughly 20 percent.2

Cholesterol is also present in membranes of organelles inside the cells, although it usually makes up a smaller proportion of the membrane. For example, the mitochondrion, the so-called "power-house" of the cell, contains only three percent cholesterol by mass, and the endoplasmic reticulum, which is involved in making and modifying proteins, is six percent cholesterol by mass. 3

# **Cholesterol Maintains the Integrity of the Cell Membrane**

Surrounding each of our cells is a membrane called the *plasma membrane*. The plasma membrane is a continuous double-layer of *phospholipids*, interweaved with cholesterol and proteins. *Phospholipids* are composed of two fatty acids attached to a phosphate compound as a head.

The phosphate head is water-soluble, also called "hydrophilic" (water-loving), and the fatty-acids are water-insoluble, or "hydrophobic" (water-fearing). Since outside the cell is a water-containing, or aqueous, environment, and inside the cell is also aqueous, the phosphate heads of the phospholipids face both the cell's inside and the environment outside the cell, while the fatty acids face the inside of the membrane.

The membrane is fluid, and the molecules are always moving. It has about the same consistency as olive oil.

Cholesterol is an *amphipathic molecule*, meaning, like phospholipids, it contains a hydrophilic *and* a hydrophobic portion. Cholesterol's hydroxyl (OH) group aligns with the phosphate heads of the phospholipids. The remaining portion of it tucks into the fatty acid portion of the membrane.

Because of the way cholesterol is shaped, part of the steroid ring (the four hydrocarbon rings in between the hydroxyl group and the hydrocarbon "tail") is closely attracted to part of the fatty acid chain on the nearest phospholipid. This helps slightly immobilize the outer surface of the membrane and make it less soluble to very small water-soluble molecules that could otherwise pass through more easily.4

Without cholesterol, cell membranes would be too fluid, not firm enough, and too permeable to some molecules. In other words, it keeps the membrane from turning to mush.

# **Cholesterol Helps Maintain the Fluidity of Cell Membranes**

While cholesterol adds firmness and integrity to the plasma membrane and prevents it from becoming overly fluid, it also helps maintain its fluidity.

At the high concentrations it is found in our cell's plasma membranes (close to 50 percent, molecule for molecule) cholesterol helps separate the phospholipids so that the fatty acid chains can't come together and cyrstallize.5

Therefore, cholesterol helps prevent extremes-- whether too fluid, or too firm-- in the consistency of the cell membrane.

# **Cholesterol Helps Secure Important Proteins in the Membrane**

The plasma membrane contains many proteins that perform important functions like channeling or pumping substances into and out of the cell, attaching to other cells, forming borders to keep other proteins in one specific part of the cell, communicating with nearby cells, or responding to endocrine hormones from far-away cells.

Because certain proteins' size or shape requires a thicker phospholipid bed to sit in, and because certain proteins need to stick together to function properly, the fluidity of the cell membrane, where the molecules are constantly moving randomly, could pose a problem.

Fortunately, the plasma membrane contains many *lipid rafts* where proteins are secured. A lipid raft contains high concentrations of cholesterol and *sphingolipids*-- a type of phospholipid-- containing longer and more saturated fatty acid tails.

Because the fatty acids are longer and more saturated (straighter), they aggregate more, which cholesterol also helps. That part of the membrane is also thicker, making it ideal for accommodating certain proteins.6

Since the fatty acids in lipid rafts are longer, the phospholipids also move in sync with the phospholipids on the other side of the membrane.

In the rest of the membrane, the phospholipids on one side of the membrane move independently of those on the other.7

By stabilizing certain proteins together in lipid rafts, cholesterol is important to helping these proteins maintain their function.

This could range from forming blood clots or thinning blood, to allowing sugar into your cells, to burning fat, to regulating calcium in your blood, and literally includes, in some way, most of the functions in your body, although which proteins exist in lipid rafts and which do not is still being researched.

It is the proteins, after all, by which cells communicate with one another. If cells didn't communicate with one another, you and I would be a large pile of unrelated cells rather than the individuals that we are.

You can peruse the references, share this article, or leave a comment below.

Read more about the author, Chris Masterjohn, PhD, [here.](http://www.cholesterol-and-health.com/about-cholesterol-and-health.html)

# What is the Role of Cholesterol in a Cell Membrane?

by ADAM CLOE  Last Updated: Aug 16, 2013

Most people know about cholesterol because of its ability to cause heart disease and atherosclerosis. However, cholesterol has a number of other important functions in the body. Aside from its role in making steroid hormones, cholesterol is also an important component of the membrane that surrounds all cells in the human body.

## Cell Membrane Components

Cells are surrounded by a membrane that is made out of lipids. Specifically, the cell membrane contains a double layer of lipids called phospholipids (because they have a phosphate molecule attached to them). Cholesterol is another lipid which can be found within the cell membrane and, according to Choleterol-and-Health.com, it can represent 50 percent of the membrane in some cells.

## Support

One role of cholesterol is to help give the cell membrane extra support. Cholesterol is more rigid than some of the other lipids in the membrane. As Cytochemistry.net explains, cholesterol helps to immobilize some of the lipid molecules around them. This extra rigidity makes the cell membrane stronger and makes it harder for small molecules to pass through the membrane. The presence of cholesterol allows the cell membrane to be strong enough to hold the cell together and to serve as an effective barrier to ions.

## Membrane Fluidity

Despite the fact that cholesterol is more rigid than some of its neighboring lipids, cholesterol also has an important role in keeping the cell membrane fluid. Cholesterol helps generate some extra space between the lipids, which keeps them from gelling together into their "crystalline" state. This allows lipids to move freely throughout the membrane as needed.

## Lipid Rafts

An article in PNAS (Proceeding of the National Academy of Sciences) explains that cholesterol also has an important role in the construction of special parts of cell membranes called lipid rafts. Lipid rafts are made up of high amounts of cholesterol and special kinds of lipids called sphingolipids. These rafts allow some sections of the membrane to be distinct from other areas.

## Lipid Raft Function

Lipid rafts are important for many cellular actions. Some lipid rafts are needed in order to export proteins out of the cell. Other lipid rafts are used to anchor specific proteins in the membrane and keep protein clusters together. Some pathogens (like viruses and bacteria) also target lipid rafts in order to get into the cell.

This lesson looks at the details of the cell membrane. It will focus on the structure of the membrane and cholesterol's role in maintaining a healthy, strong cell membrane.

## Function of Cholesterol in the Cell Membrane

When you sleep in a cold room, you may have a couple of layers of blankets that you roll up in to keep warm. The blankets help protect your body from the cold room; this is similar to the role the cell membrane plays when it 'rolls up' around a cell. Your body is made up of trillions of these cells, which are small units working together to create organisms like you. The cells in your body have a membrane that acts like your blanket and surrounds and protects the cell. If you travel inside the cell you would find it is filled with fluid called plasma and many small parts that are vulnerable to the outside world. The **cell membrane**, also called **plasma membrane**, surrounds the cell and protects what is inside from the outside environment. This lesson will look at the cell membrane in detail and focus on cholesterol, which is one of the components found in the cell membrane.

The cell membrane is described as a fluid mosaic. This is because the structure of the membrane is flexible and fluid, and also made up of a variety of molecules. Four main molecules make up the mosaic structure of the cell membrane. They are phospholipids, cholesterol, proteins, and carbohydrates. Each of these molecules gives the cell membrane unique characteristics due to the way the molecules interact with each other. To understand cholesterol's role in the membrane, let's look at the basic structure of a cell membrane.

## Details of the Cell Membrane

The phospholipids are the molecules that make up most of the membrane structure. A single phospholipid molecule has two parts, a head which is attracted to water, and a tail that is repelled by water. The head is also called **hydrophilic**, or water loving. The tail is often called **hydrophobic**, water hating. Both the outside and inside of a cell are aqueous. This causes the phospholipids to orient themselves into layers when in water solutions, just like vegetable oil does when mixed with water.

This aqueous environment causes two phospholipids to stack together like two magnets. They attract tail to tail with the heads facing outwards. Then these two molecule structures join side-by-side with two other molecule structures. This creates a two-layer membrane that surrounds the cell. The cell is just like you sleeping rolled up in a quilt and sheet. The outside ''blanket'' of the membrane has heads pointed out and tails facing in. The inside ''blanket'' has heads pointing towards the plasma, and tails facing in. The tails that face in bond weakly to each other. The bond is similar to the static of your sheets allowing for a temporary bond to the quilt. These two layers do not lock together, but instead end up sliding past one another like the quilt and the sheet. It is important to the vitality of the cell that the membrane layers remain fluid.

| phospholipidbilayercell |
| --- |
| ***Image shows a single phospholipid and what phospholipid molecules do in aqueous environments*** |

## Role of Cholesterol

Cholesterol is similar to phospholipids in regards to having a hydrophilic, and a hydrophobic portion. This would be referred to as being **amphiphilic**. The hydrophilic portion of the cholesterol bonds to the hydrophilic heads within the membrane layers. The hydrophobic regions of the cholesterol fit in between the tails of the membrane layer. The cholesterol interacts with the tails of the membrane and gives the membrane unique properties. The cholesterol assists with stability of the membrane, keeps the membrane from becoming solid at cooler temperatures, and helps anchor molecules, like protein, in the membrane. Let's take a look how cholesterol does this.