Osmosis

by Sophia

WHAT'S COVERED

In this lesson, you will learn about the process and roles of osmosis. Specifically, today's lesson will cover:

1. Osmosis Overview

Osmosis is the movement of water across a selectively permeable membrane. When you're talking about osmosis, you're talking about water. If you think back to diffusion, diffusion is the movement of any substance from an area of high concentration to low concentration. However, when you talk about osmosis, you're focusing specifically on water moving across a **selectively permeable** membrane.

This means the membrane can determine what passes through it. Some membranes are not going to allow **solutes** to pass. Instead of those solutes being able to pass back and forth to even out concentrations, water is going to have to pass back and forth to even out concentrations.

↱ EXAMPLE Consider lemonade made with sugar. If you make a batch that's too sweet, you can start over and add less solute (sugar). This is like diffusion: the sugar is being removed from a highly concentrated solution. Alternatively, if your lemonade is too sweet, you can add more water. This is like osmosis: Instead of removing the highly concentrated solute (sugar), you increase the water to reduce the concentration.

TERMS TO KNOW

Osmosis

The movement of water across a selectively permeable membrane.

Selectively Permeable

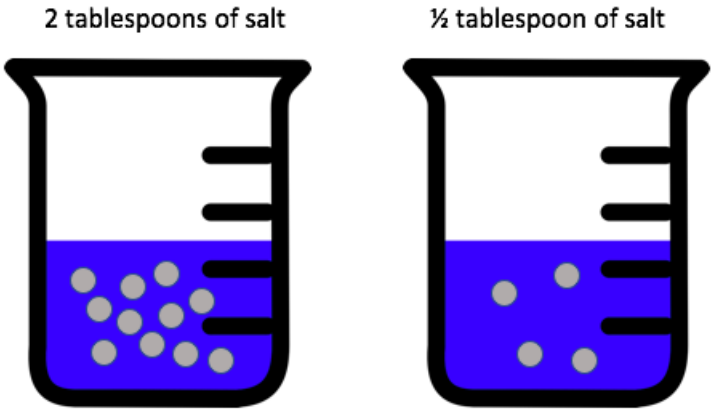
A membrane that can regulate which molecules are able to pass through the membrane and which cannot.

Solute

The minority component in a solution (mixture), dissolved in a solution.

2. Concentration

The purpose of osmosis is to even out solute concentrations across the membrane by moving water. To get a better understanding, take a look at the image below.



There are two beakers, and there is an equal amount of water in each of them. Now, let's say you drop two tablespoons of salt into the beaker on the left (the dots represent molecules of salt). In the one on the left, you have quite a few molecules of salt filling up the water.

Then let's say you only drop half a tablespoon into the beaker on the right. You'll notice that you have the same amount of water in each of the beakers, but the one on the left has significantly more salt than the one on the right. Therefore, the one on the left would have a higher concentration of salt than the beaker on the right would. Think of concentration as the ratio of solutes to the **solvent**.

↱ EXAMPLE In a solution of salt water, the salt is the solute and the water is the solvent.

TERM TO KNOW

Solvent

A substance that dissolves things to create a solution (mixture).

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3. Tonicity

Tonicity closely relates to concentration and describes the concentration of solutes across a membrane.

When you have a concentration of solutes equal across the membrane, the concentration of solutes on one side of the membrane is equal to the concentration of solutes on the other side of the membrane. You'd refer to that as being **isotonic**.

The side of the membrane that has a higher concentration of solutes is going to be referred to as **hypertonic**, while the side of the membrane with a lower concentration of solutes is going to be **hypotonic**.

TERMS TO KNOW

Tonicity

The concentration gradient of a solute in a solution.

Isotonic

A type of tonicity where there is an equal amount of solute on both sides of a membrane.

Hypertonic

A type of tonicity where there is a higher concentration of solutes outside of a cell than inside a cell.

Hypotonic

A type of tonicity where there is a lower concentration of solutes outside of a cell than inside a cell.

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4. Passive Transport

Osmosis is a form of **passive transport**. This means that it does not require the use of ATP, or cellular energy, for it to occur. It happens naturally because water will be moving from an area of high concentration to an area of low concentration to even out the concentration across a membrane.

TRY IT

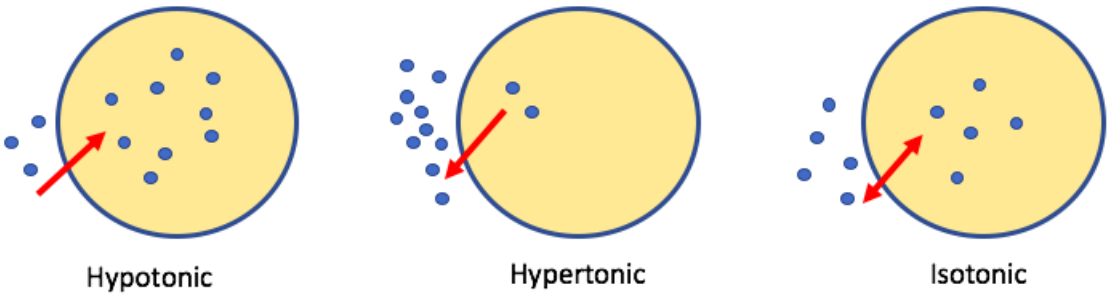
You have a cell that has a high concentration of solutes inside of it and a lower concentration of solutes outside of it. If the solutes cannot pass through the membrane, water needs to move. So, which direction would water move in this case to even out the concentration? +

Water would move into the cell.

You have a cell that has a high concentration of solutes outside of it and a lower concentration of solutes inside of it. Which direction is water going to flow if the solutes can't flow back and forth? +

Water is going to have to flow out of the cell to even out those concentrations.

Take a look at the examples of cells below to better understand.



For the first cell, you'll notice the outside would be referred to as hypotonic because it has a lower concentration. Water is going to have to flow into the cell to even out the concentration.

For the second cell, you can see that the outside of the cell is hypertonic, having more solutes than the inside of the cell.

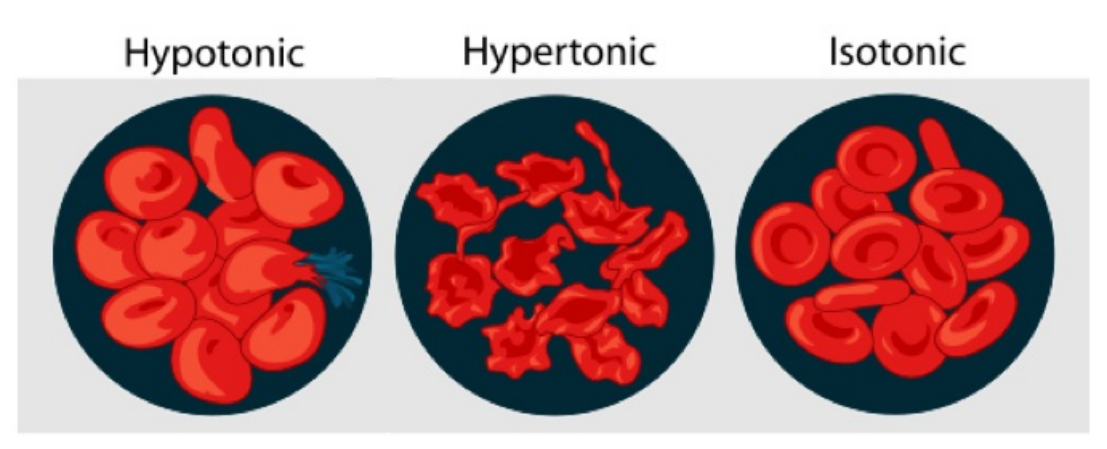
And in the last cell, you'll notice we have the same number of solutes inside and outside the cell. So, water is

going to move equally into and out of the cell in this case. You're not going to have a net movement of water; the same amount of water flowing in is flowing out naturally.

The type of condition that a cell is in can also have an effect on the cell.

IN CONTEXT

Red blood cells are very sensitive to tonicity and solute concentration. When red blood cells are in certain conditions, this will affect what the cell looks like. Take a look at the three images of red blood cells below.



If a red blood cell is in a hypotonic solution, water is going to move into the blood cell and going to cause the blood cell to expand and possibly explode.

When blood cells are within a hypertonic environment, the water will leave the cell and the cell will shrink.

However, if a red blood cell is in an isotonic condition, you have equal amounts of water moving into and out of the cell. This will not have an effect on what that cell looks like.

TERM TO KNOW

Passive Transport

Movement of molecules across a membrane without the use of energy.

SUMMARY

This lesson has been an overview of the **process of osmosis**, as well as the role of osmosis in our bodies. Specifically, you looked at **concentration**, **tonicity** and **passive transport**. Finally, you got some examples of how the condition (hypotonic, hypertonic or isotonic) that a cell is in can have an effect on what the cell looks like.

Keep up the learning and have a great day!

Source: THIS WORK IS ADAPTED FROM SOPHIA AUTHOR AMANDA SODERLIND

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TERMS TO KNOW

Hypertonic
A type of tonicity where there is a higher concentration of solutes outside of a cell than inside a cell.

Hypotonic
A type of tonicity where there is a lower concentration of solutes outside of a cell than inside a cell.

Isotonic
A type of tonicity where there is an equal amount of solute on both sides of a membrane.

Osmosis
The movement of water across a selectively permeable membrane.

Passive Transport
Movement of molecules across a membrane without the use of energy.

Selectively Permeable
A membrane that can regulate which molecules are able to pass through the membrane and which cannot.

Solute
The minority component in a solution (mixture), dissolved in a solution.

Solvent
A substance that dissolves things to create a solution (mixture).

Tonicity
The concentration gradient of a solute in a solution.