no.

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Physiology

Doctor 2019 | Medicine | JU

◉ Sheet ○ Slides

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Doctor

FAISAL MOHAMEMAD

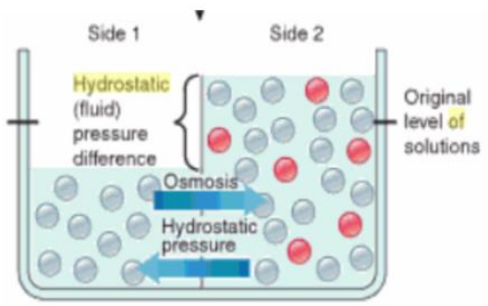
Smallest review

Hellow , how are you, does anyone have any question? Doctor why are you late? Plz change your transport method .. doctor Faisal jokingly ^_^

***AT THE FIRST IN THIS SHEET:

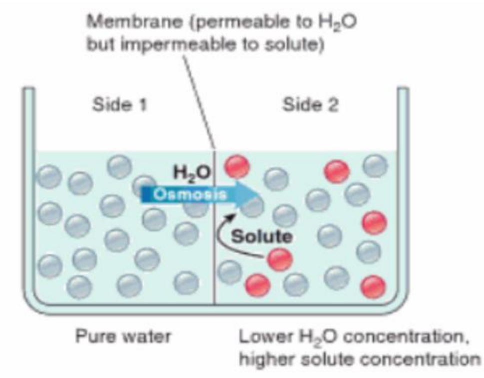
Osmotic pressure according to van Hoffs equation (π = nRT)

n= number of moles, R= gas constant, T= temperature in kelvin.



- Osmotic pressure PULLS the water towards the high osmotic side. When the column of water rises the pressure is increased, which pushes the water towards the low osmotic side (hydrostatic pressure).

NOTE: "You can prevent osmosis by applying pressure equal to the osmotic pressure"



For this figure: Both sides have the same HYDROSTATIC pressure (same height) But side 2 has higher Osmotic pressure (due to the solutes)..

- The water will keep moving until it reaches a balanced state (hydrostatic pressure equals osmotic pressure).

-"Two solutions can have the same molarity but different osmolarity".

---→ In the case of NaCl for example, there is Avogadro number of Na(sodium) and Avogadro number of Cl, But glucose doesn't disassociate in water, so there is only Avogadro number of glucose.

OsM of 1 M glucose solution =1 OsM

OsM of 1 M NaCl solution = 2 OsM

The osmotic pressure of an ionic solution is → $\pi = i\,n\,R\,T$

HINT: "i" represent to the no. of ions formed by dissociation per molecule.

→Difference between osmolarity and osmolality←

For osmolarity: you dissolve the substance in the solution, then you add solution until its volume reaches of 1 liter.

For osmolality :you get 1 kilogram of water and dissolve the substance in it.

"""The difference between them is very little, and they are used interchangeably"""

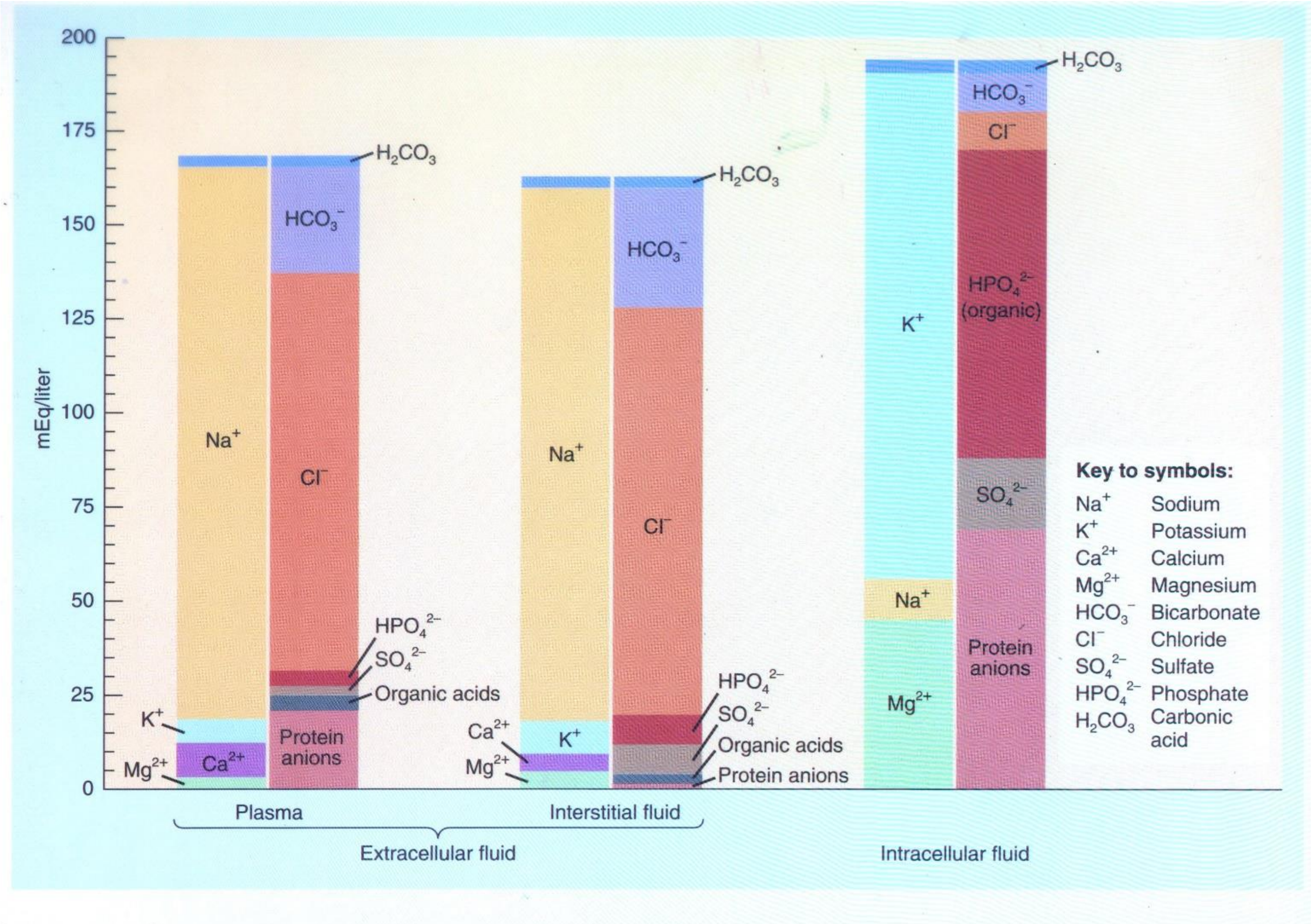
So, as we mention above if we compute the osmosis of NaCl and $C_6H_{12}O_6$ FOR THE GIVEN information :

150 mM of NaCl = 300 OsM

150 mM of glucose = 150 OsM

300 millimolar is the normal osmolarity of our bodies and we called it as isoosmolar, More than 300 is called hyperosmolar solution, Less than 300 is called hypoosmolar solution.

So, you just have to cry….



Comparison of Electrolyte and Protein Anion Concentrations in the Body Fluid Compartments, Fig# 27.4

There are two kinds of ions:

Positive ions are called Cations, Negative ions are called anions (anion is one word), they are called so because positive ions are attracted to the negative pole (cathode), and negative ions are attracted to the positive pole (anode).

	Major cation	Major anion
Extracellular fluid	Na+ (around 140 millimoles)	Cl- (around 110 millimoles)
Intracellular fluid	k+	HPO_4^{2-} AND protein anions

The main difference between Plasma and interstitial fluid is protein anions, Because they don't pass through the membrane .

Tonicity and its effect on RBCS

→ If a red blood cell is put in an isotonic solution, the net water movement is zero.

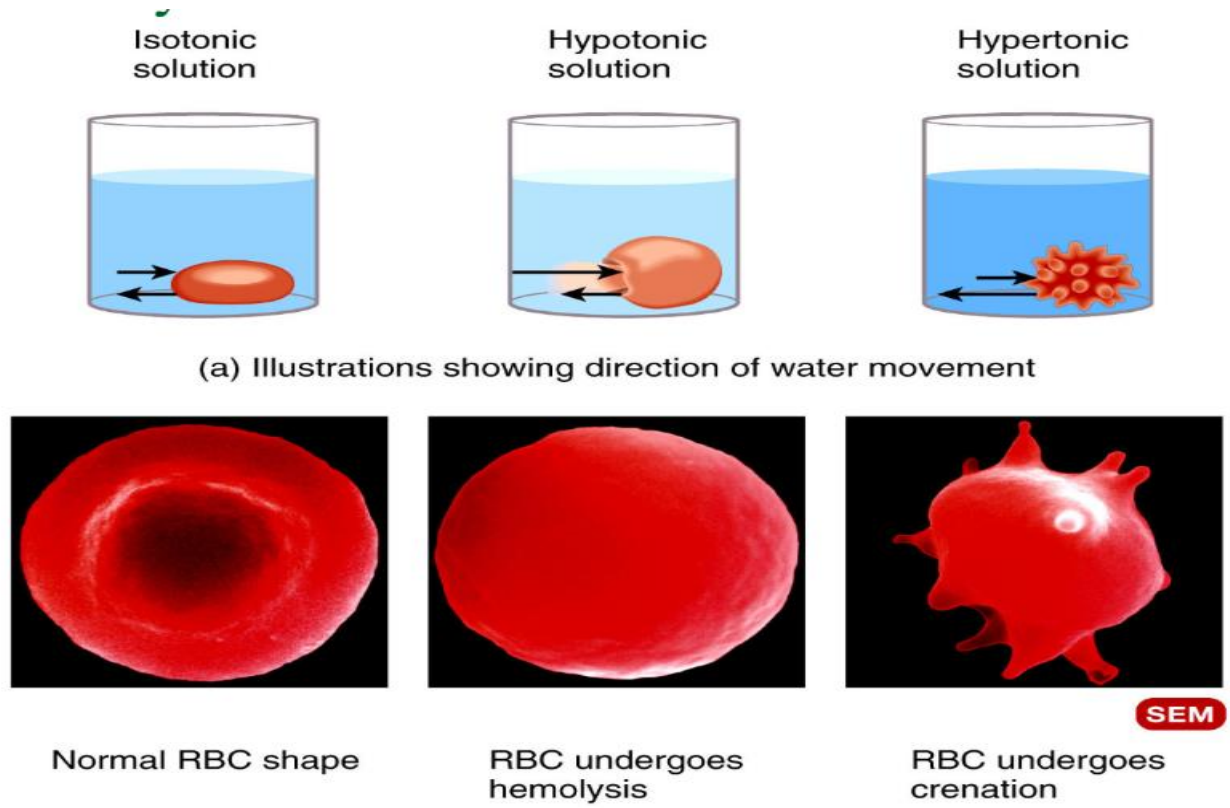
→ If put in an hypotonic solution, water will move towards the higher osmolarity it will move inside the cells, causing hemolysis, Hemolysis causes death

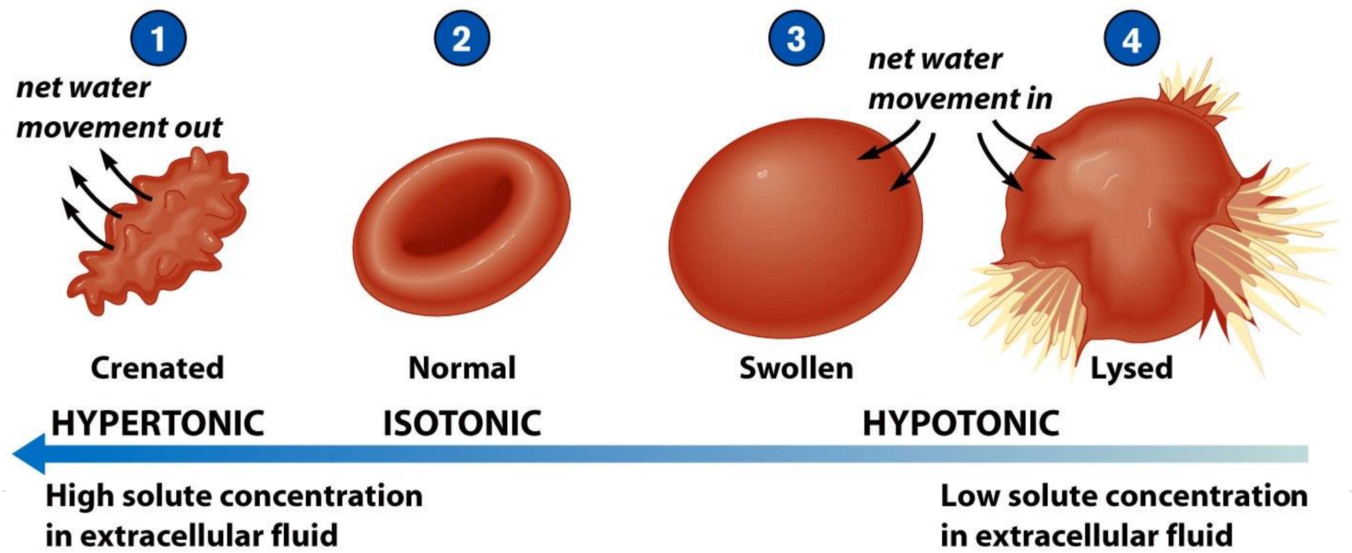
HINT

hemo = blood

lysis = break

→ If put in a hypertonic solution the water will move outside the cell, causing crenation. (shrinking)





Active transport

1-primary active transport: requires energy because substances are moving against concentration gradient, best example are pumps. They hydrolyze the ATP directly. Best example for pumps is the sodium potassium pump.

They pump 3 Na^+ from inside to outside and 2 K^+ from inside to outside. It hydrolyses ATP that's why it's called ATPase. (Atp = energy)

Hydrogen pump (in the stomach) pumps hydrogen into the stomach against the concentration gradient (that's why the stomach pH is 2).

2-secondary active transport:

It also moves substances against their concentration gradient. Energy is also used but it is used INDIRECTLY.

For example, it moves Na^+ from outside to inside in exchange for moving Ca^{2+} from inside to outside. (antiport or counter transport)

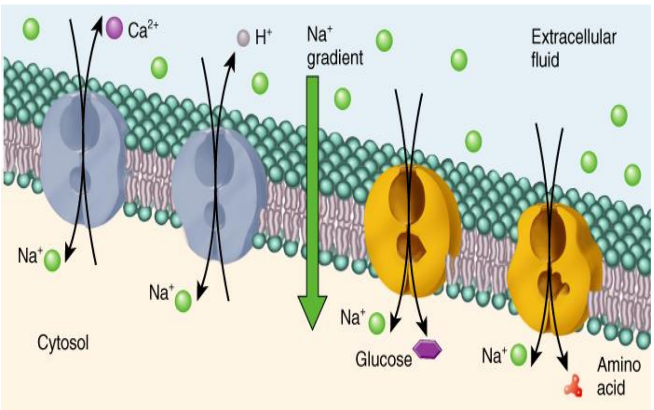
Ca^{2+} outside is more than inside.

If it keeps working the Na^+ will be equal on both sides, and if it equal then the pump stops. What keeps the Na^+ different on both sides is the sodium potassium pump (indirect transport).

The first type of secondary active transport is antiport or counter transport.

An example for counter transport is sodium hydrogen pump.

The second type of secondary active transport is symport (co-tansport),Example are the sodium glucose co-transporter and sodium amino acid co transporter.



(a) Antiporters (b) Symporters

Oooooooo ! The number of transport proteins are limited, that means they have a T_{max} (transport maximum as a saturation), don't forget that.

Up to 90% of cell energy expended for active transport and this is Energetics.

Other types of Active transport (not through the membrane,"Vesicular transport"):

1- Endocytosis: (substances enter the cell)

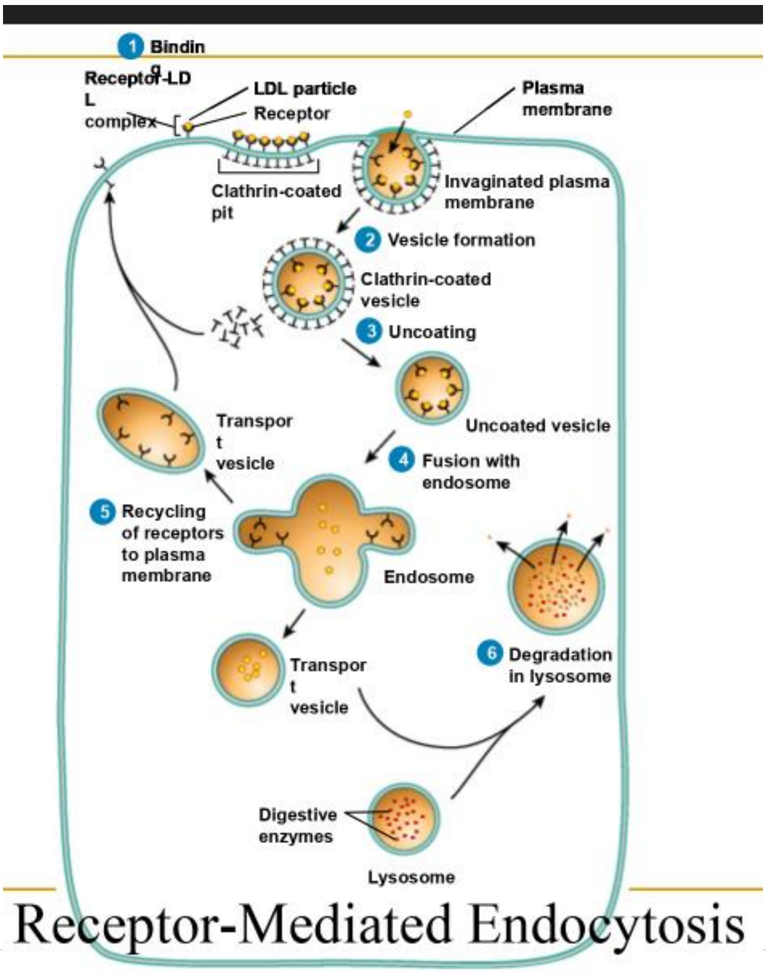
Comes in three types: (receptor-mediated endocytosis,Phagocytosis,bulk-phase -endocytosis (pinocytosis))

2- exocytosis :Such as secretion of hormones,When hormones are synthesized then altered, it has to move in a vesicle to leave the cell, and the vesicle requires energy to move through the cell.

3-Transcytosis: the substance enters the cell from one side then leaves from the other side.

about this figure:

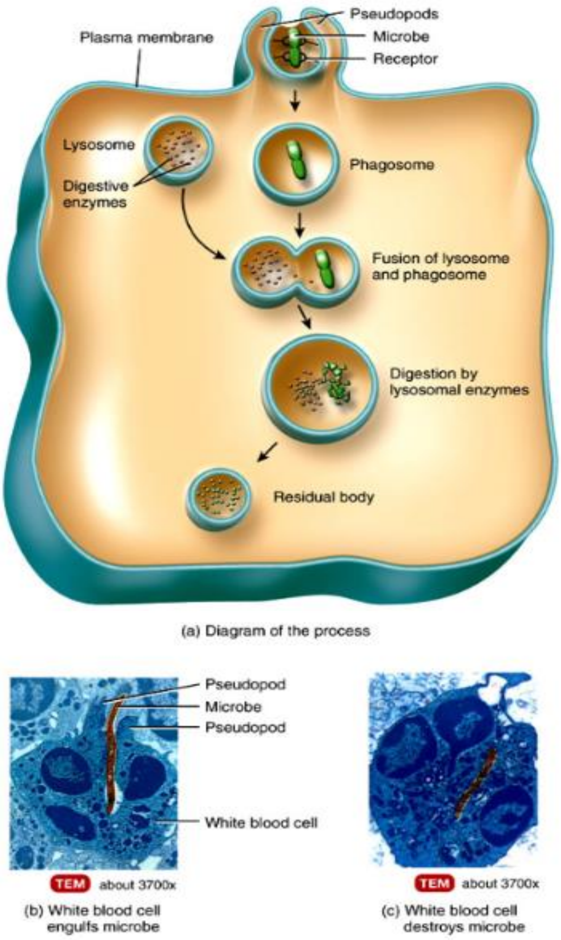
Receptor-mediated endocytosis: The substances are attached to the receptors (it might be attached by pseudopods), Then the vesicle is punched in then the vesicle might fuse with the lysosomes and the lysosome will degrade these substances.

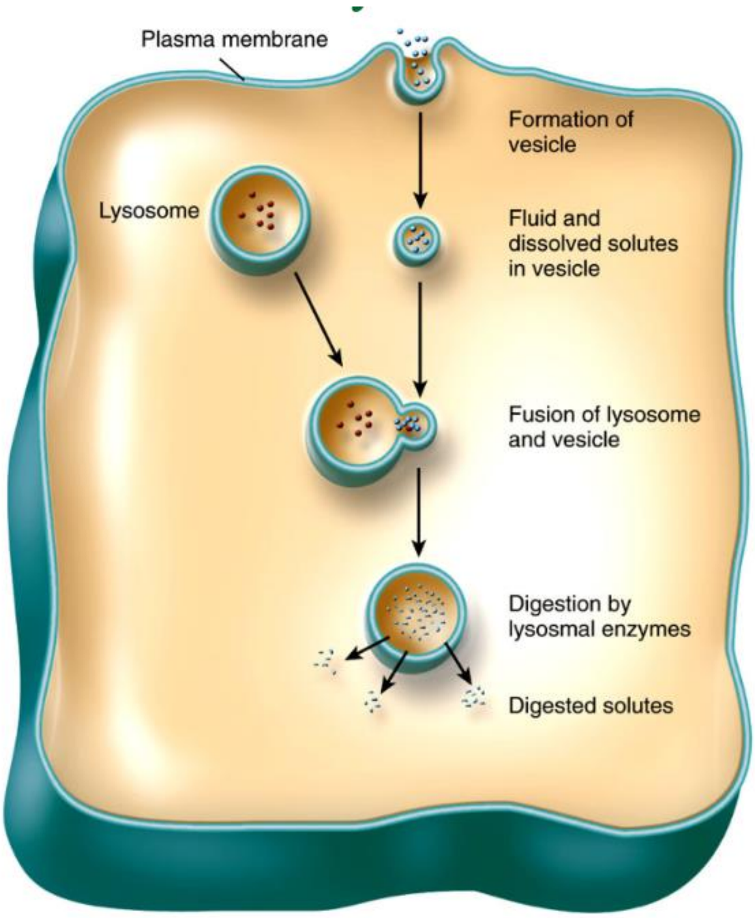


Receptor-Mediated Endocytosis

Phagocytosis:

The substance is captured by pseudopods Then the vesicle is punched in it will fuse with the lysosome and then will Be digested..





Pinocytosis

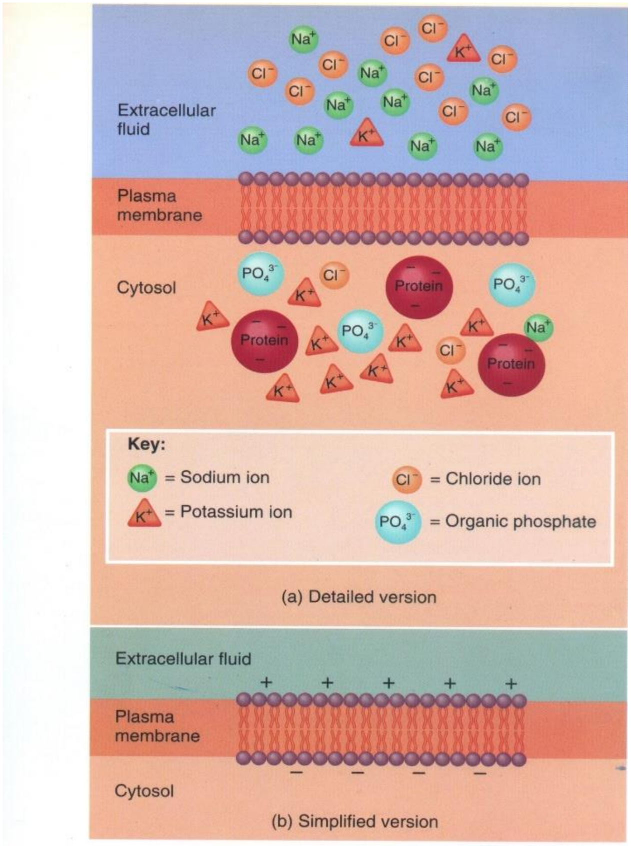
It is mainly for fluids , there is some kind of pseudopods, then its digested.

To order what you study:

Mainly outside the membrane we have sodium, inside we mainly have potassium and we also have negatively charged proteins.

In any cell the positive ions are outside and negative ions are inside. Which creates membrane potential.

NOTE: the negative ions are more inside than out side BECAUSE the cell includes some of Cl^- ,PO_4^{3-} and proteins in its cytoplasm.



Electrochemical Gradient, Fig# 3.4a-b

This is mainly caused by the (sodium-potassium) pump and selective permeability of the membrane, the membrane permeability to potassium is 100 times more permeable than to sodium which makes the outside more positive, this is called resting membrane potential.

The difference between inside and outside is around -70 (negative means that the inside is negative (toward the cytoplasm) compared to the outside, due to the selective permeability of the membrane.

All cells are polar (they all have resting membrane potentials) but not all cells have action potential reactions (only occurs in nerve and muscle cells).

"Physiology is like to be our spices on food, without it NO SAVER".

THE END

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