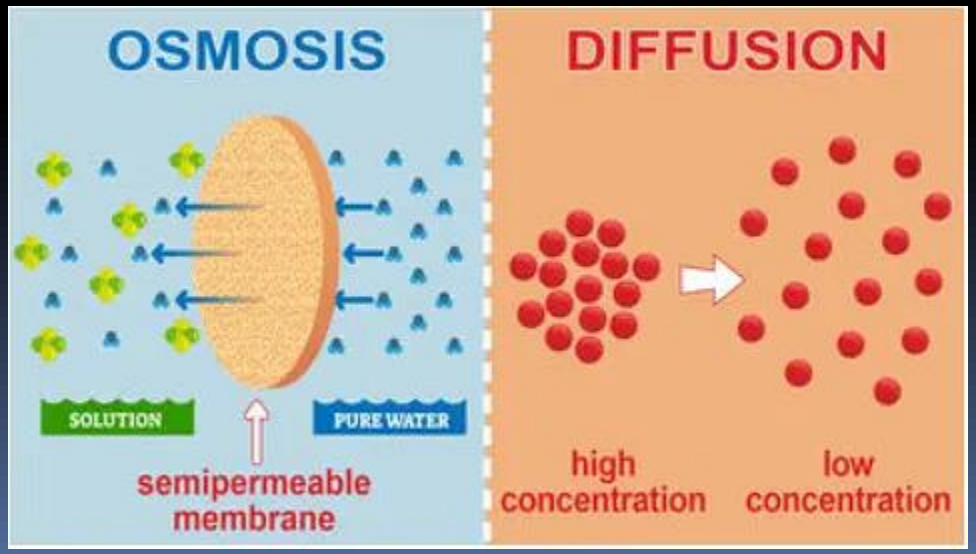
Fluid Shift
Diffusion, Osmosis
and
Hydrostatic Pressure

6th Lecture



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Movement of body fluids

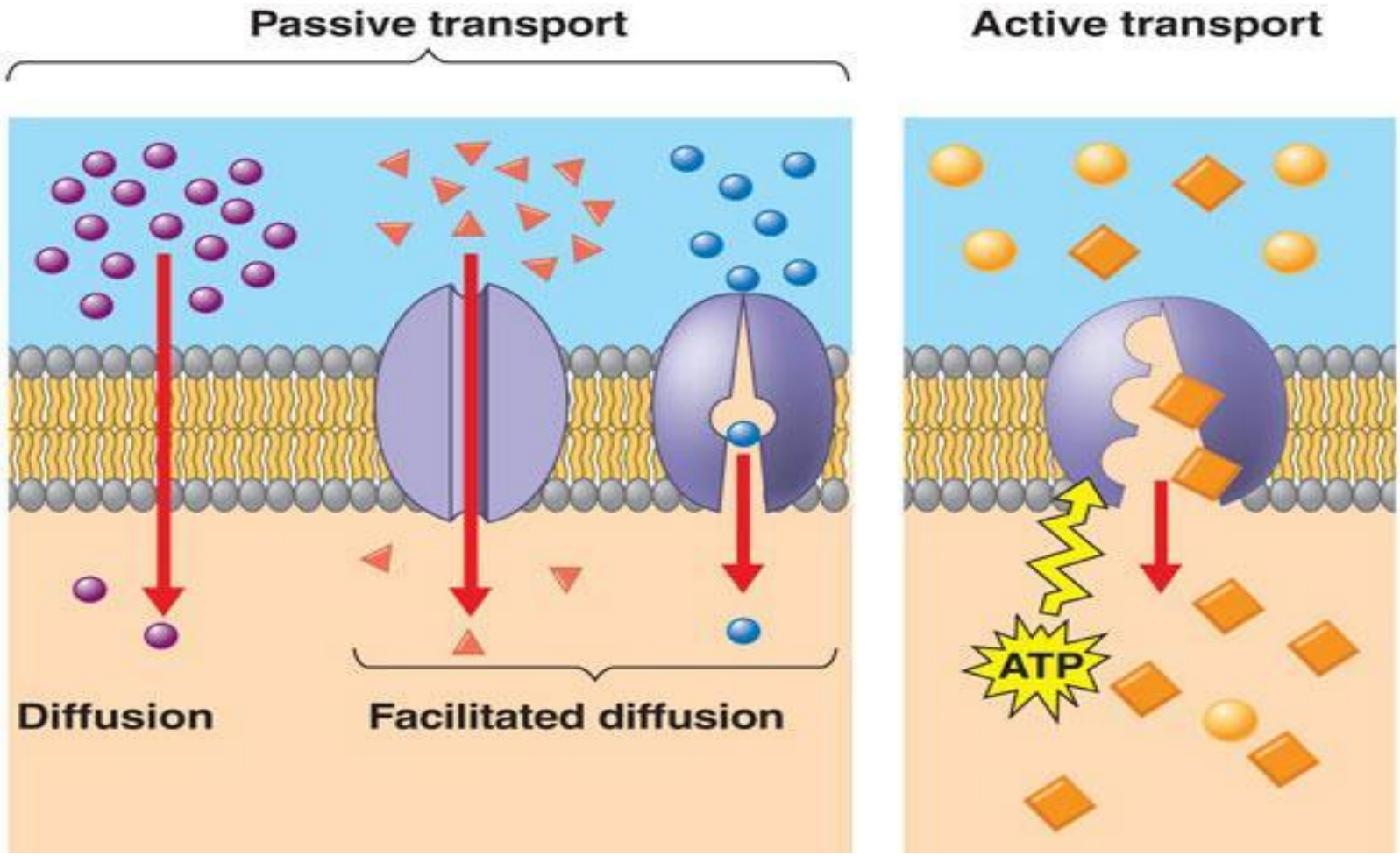
A water solution that contains nutrients, wastes, gases, salts and other substances surrounds cells. This is the external environment of a cell.

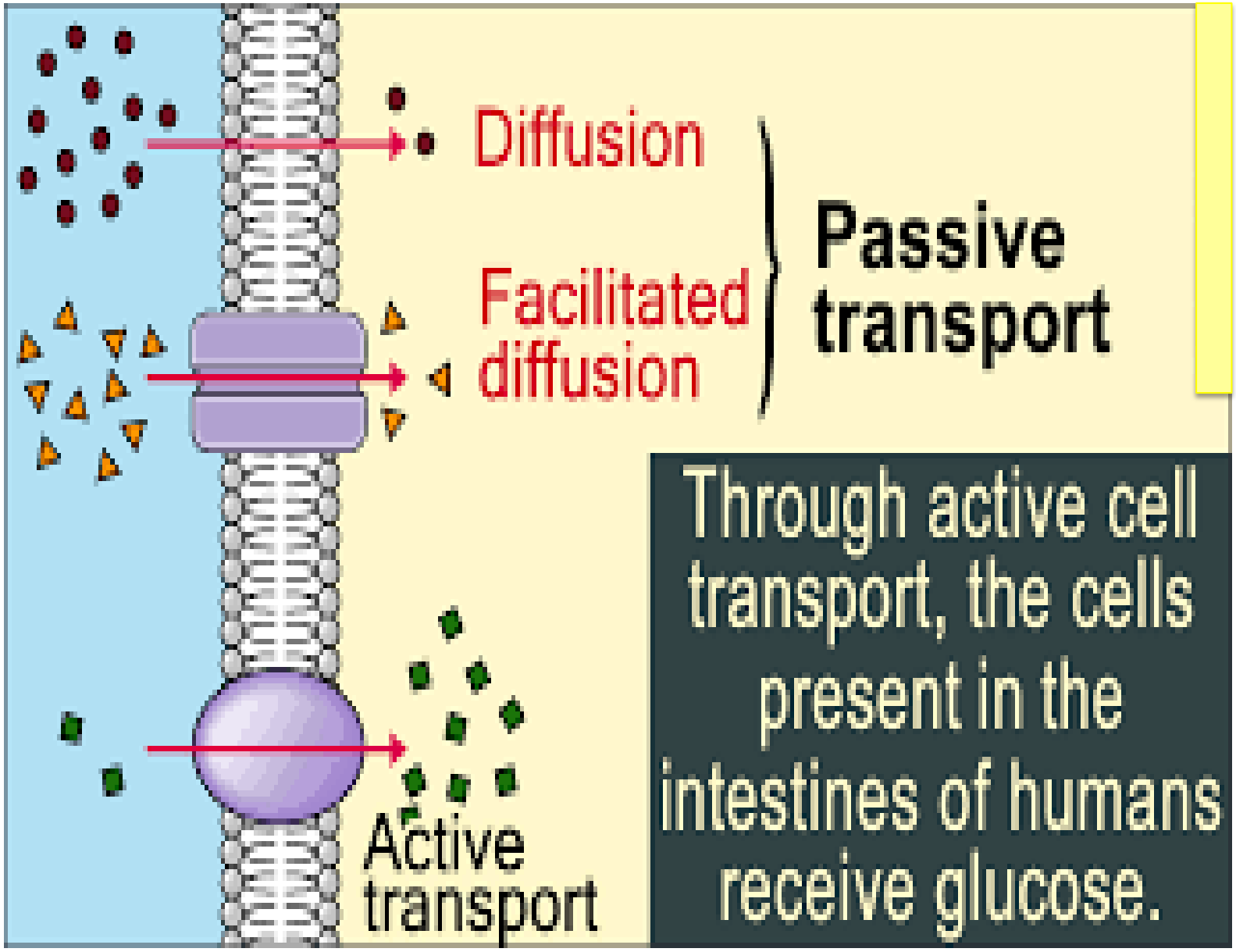
The cell's outer surface of the plasma membrane is in contact with this external environment, while the inner surface is in contact with the cytoplasm. Thus, the plasma membrane controls what enters and leaves the cell.

The membrane permits the passage of some materials, but not all. The cell membrane is said to be selectively permeable. Small molecules, for example, may pass through the membrane. If no energy is required for substances to pass through the membrane, the process is called passive transport.

Membrane transport processes

1- Passive transport
2- Active transport


Passive transport
Active transport
Diffusion
Facilitated diffusion
ATP


Diffusion
Facilitated diffusion
Passive transport
Through active cell transport, the cells present in the intestines of humans receive glucose.
Active transport

1) passive transport

- It is the movement of substances across a membrane from higher to lower concentration.
- It does not require metabolic energy.

- **simple diffusion**

It is the movement of substances from a region of high concentration to a region of low concentration.
Generally, simple diffusion of water, gases, and other small uncharged molecules across plasma membranes can occur in the absence of transport proteins.

- **facilitated diffusion.**

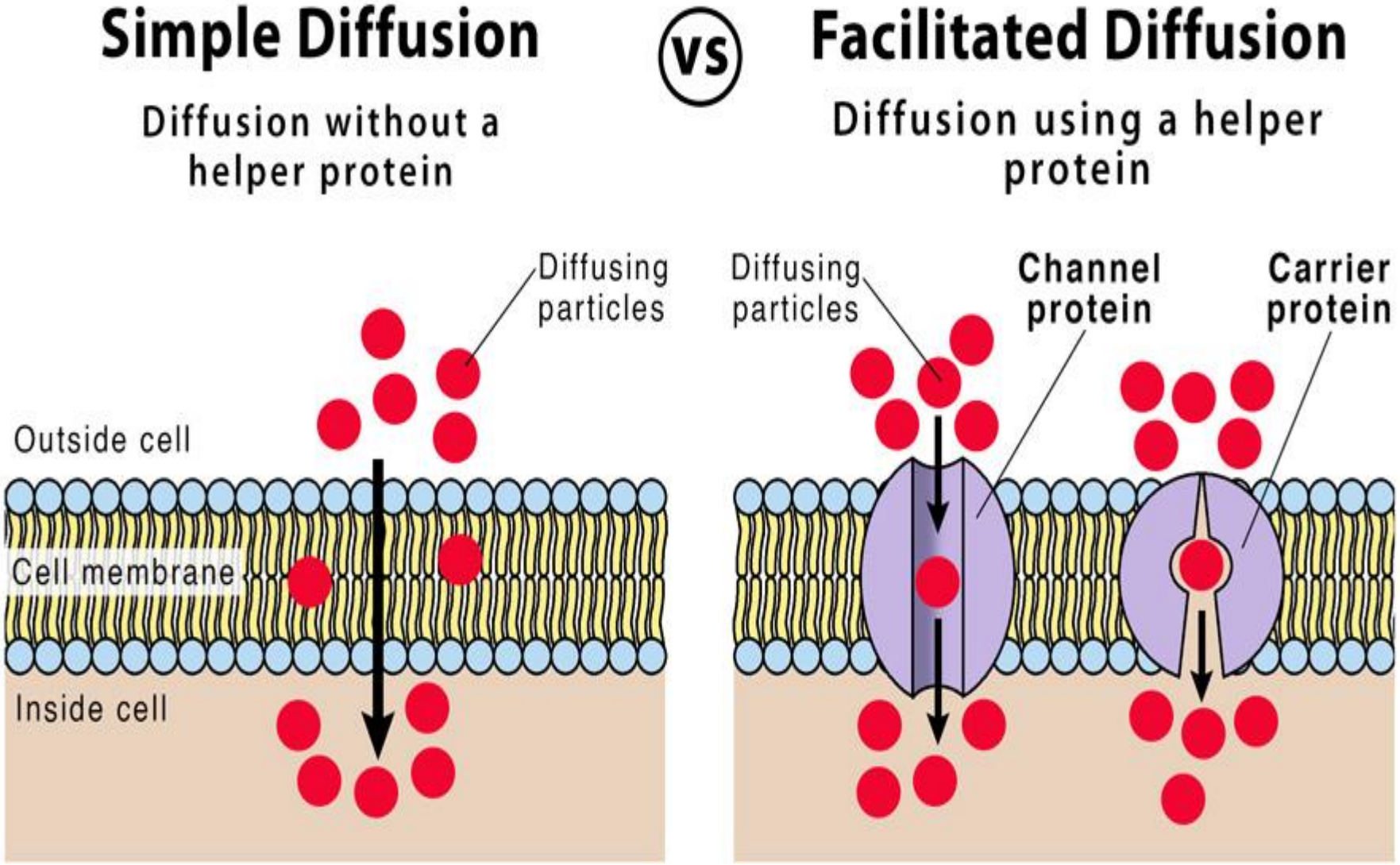
It is a transport of substances across a biological membrane from an area of higher concentration to an area of lower concentration by a carrier proteins.

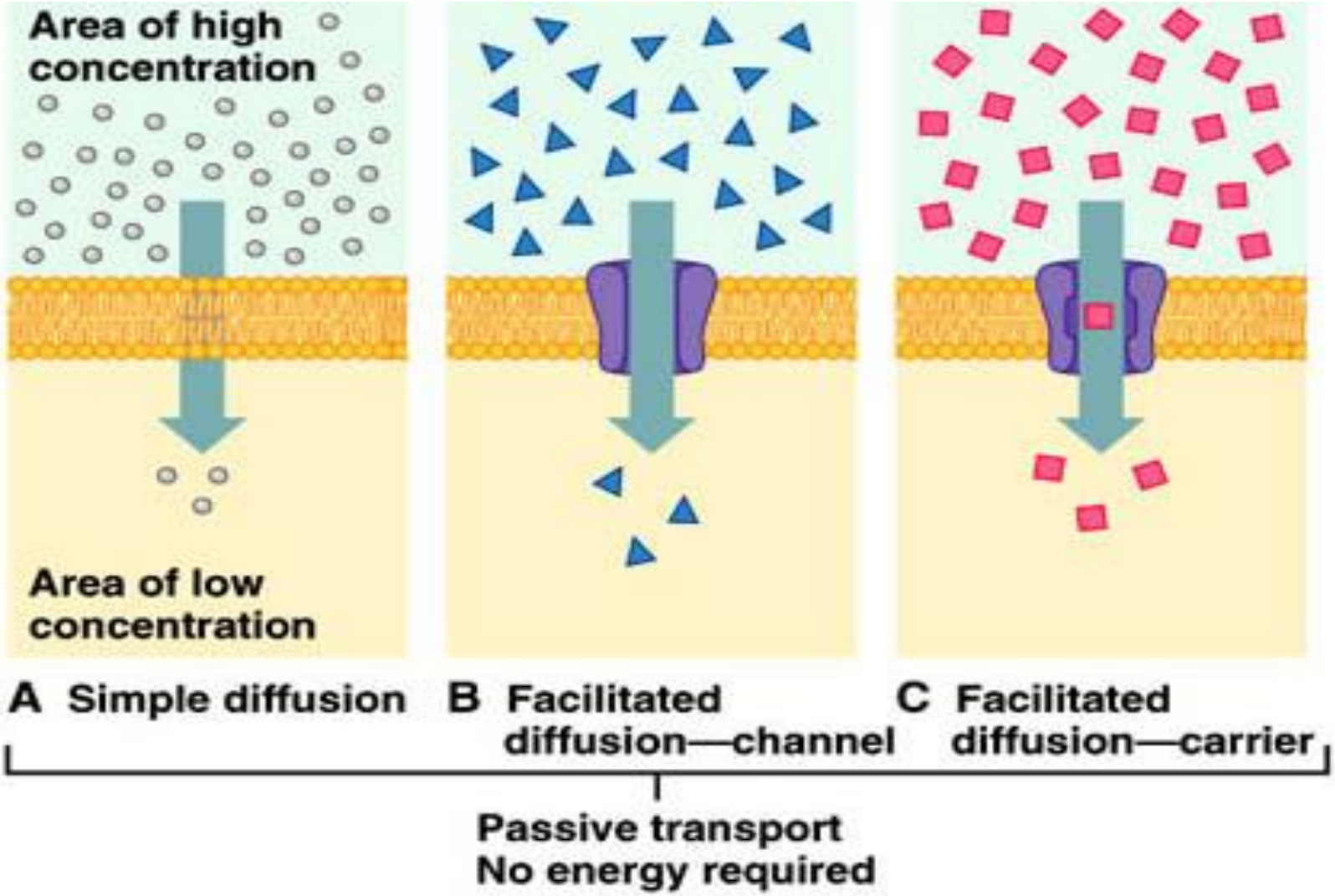
Simple Diffusion

- Through the phospholipid bilayer
- Happens to the small and non-polar particles

Facilitated Diffusion

- Through the transport protein
- Happens to large or polar particles


Simple Diffusion
Diffusion without a helper protein
VS
Facilitated Diffusion
Diffusion using a helper protein
Diffusing particles
Outside cell
Cell membrane
Inside cell
Diffusing particles
Channel protein
Carrier protein


Area of high concentration
Area of low concentration
A Simple diffusion
B Facilitated diffusion—channel
C Facilitated diffusion—carrier
Passive transport
No energy required

2) Active transport:

It is the movement of substances across a membrane against gradient (from low concentration to high concentration). Active transport requires energy and involves specific carrier proteins.

Movement of fluids due to:

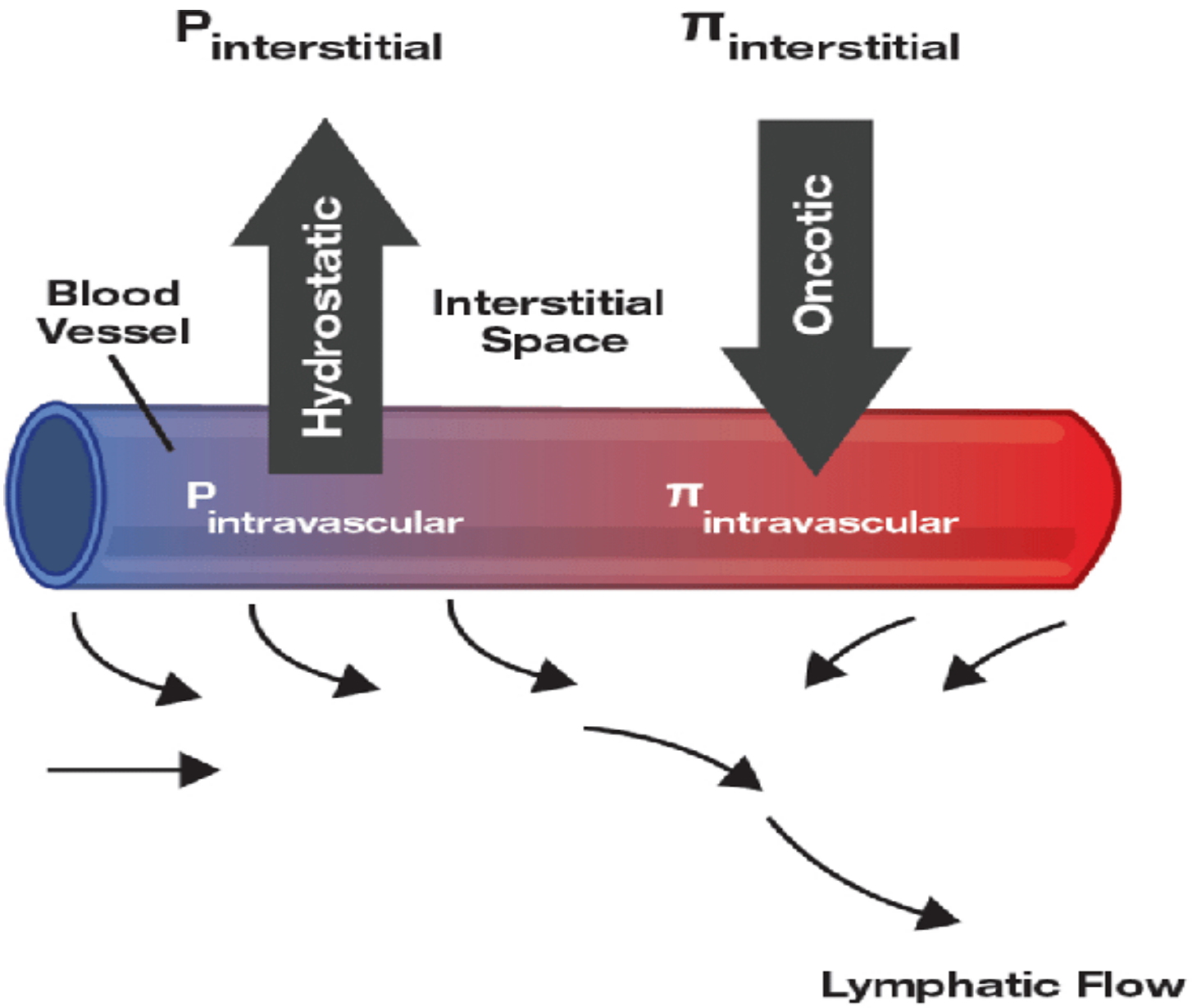
1) Hydrostatic pressure

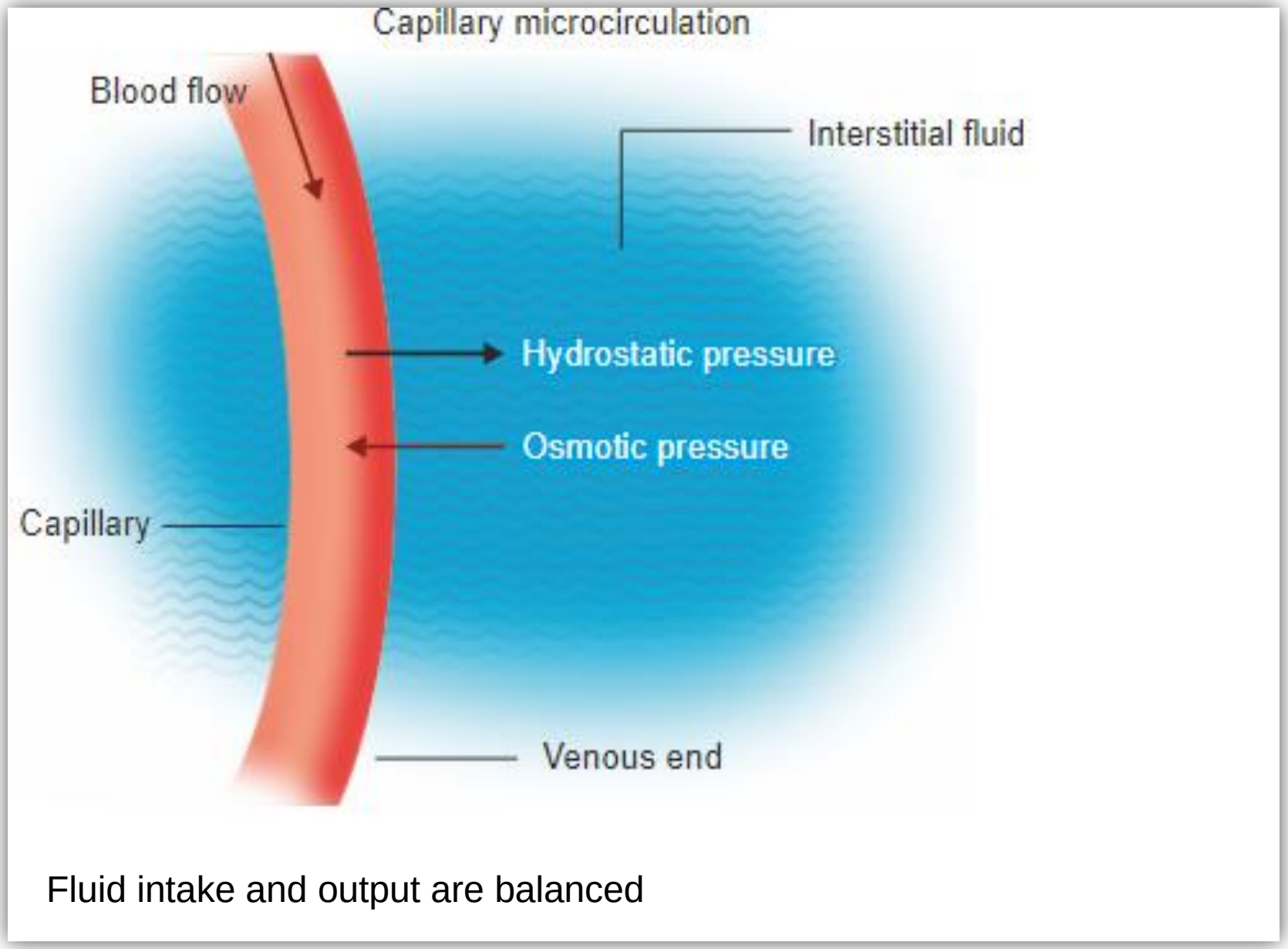
It is physiological processes that regulate fluids intake & output as well as movement of water & substances dissolved in it between the body compartments

2) osmotic pressure

The pressure exerted by the flow of water through a semi-permeable membrane separating two solutions with different conc. of solute

Whereas hydrostatic pressure forces fluid out of the capillary, osmotic pressure draws fluid back in. Osmotic pressure is determined by osmotic concentration gradients, that is, the difference in the solute-to-water concentrations in the blood and tissue fluid.


P interstitial
π interstitial
Hydrostatic
Oncotic
Blood Vessel
Interstitial Space
P intravascular
π intravascular
Lymphatic Flow



Fluid intake and output are balanced

Osmosis: It is diffusion of a solvent (usually water molecules) through a semi-permeable membrane from an area of low solute concentration to an area of high solute concentration.

Osmotic pressure:

It is pressure which forces the water to move from where there is little dissolved solute to where there is lots dissolved solutes.

- **It is determined by the number of particles per unit volume of fluids.**
- **The amount of osmotic pressure exereted by a solute is proportional to the number of molecules or ion**

Water Balance:

Water balance exists when water intake equals water output.

Water Intake:

-The volume of water gained each day varies from one individual to the next.

-About 60% of daily water is gained from drinking, another 30% comes from moist foods, and 10% from the water of metabolism .

Regulation of Water Intake:

-The thirst mechanism derives from the osmotic pressure of extracellular fluids and a thirst centerin the hypothalamus.

-Once water is taken in the resulting distention of the stomach will inhibit the thirst mechanism.

Water Output:

-Water is lost in urine, feces, perspiration, evaporation from skin (insensible perspiration), and from the lungs during breathing.

-The route of water loss depends on temperature, relative humidity, and physical exercise

Regulation of Water Output:

- The distal convoluted tubules and collecting ducts of the nephrons regulate water output.

- Antidiuretic hormone from the posterior pituitary causes a reduction in the amount of water lost in the urine.

- When drinking adequate water, the ADH mechanism is inhibited, and more water is expelled in urine.