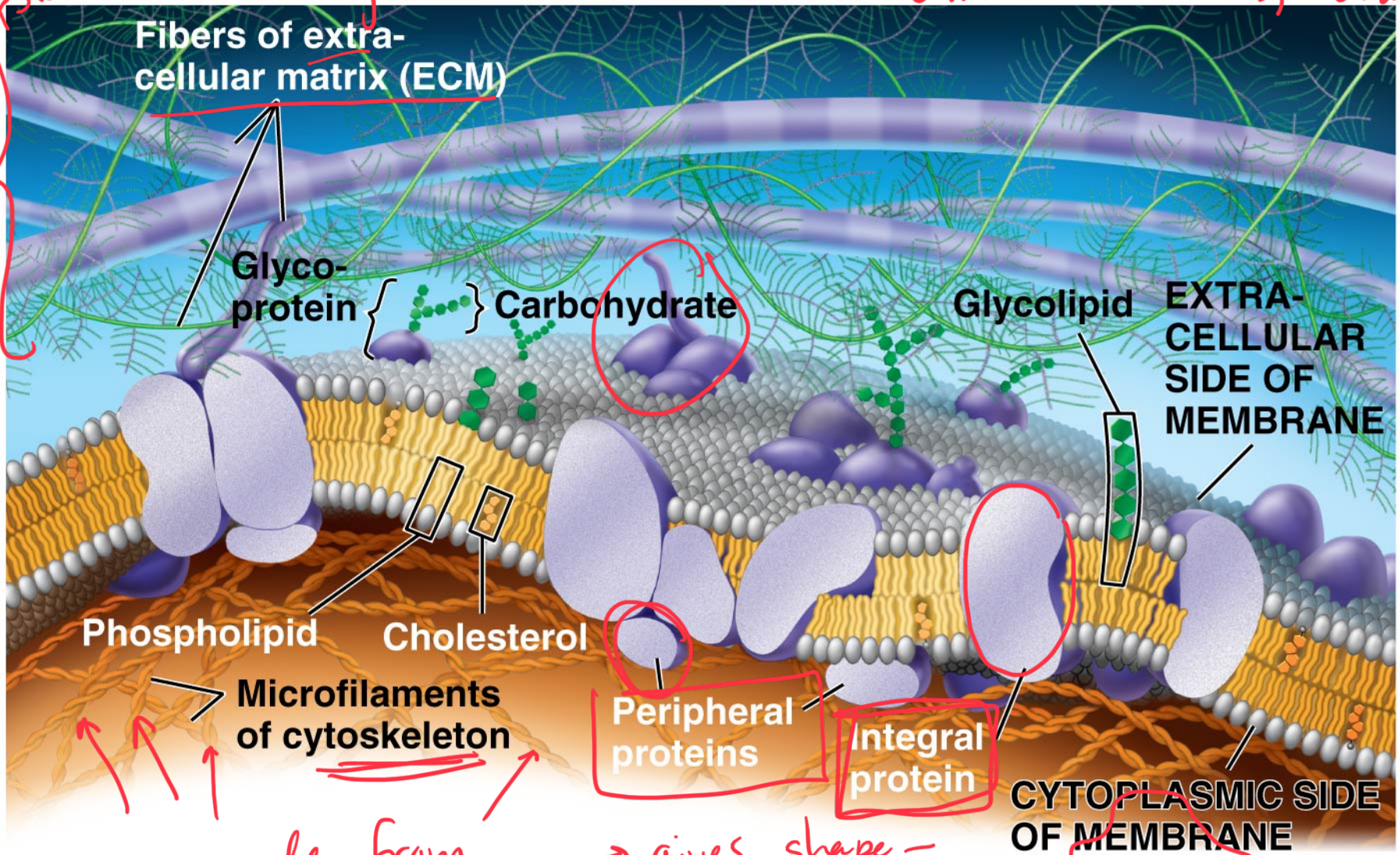
outside

carbohydrates face outside

carbohydrates used for: communication (self), draw in water



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made from proteins → gives shape – provides transport

Phospholipids

phosphate → linker

- Bilayer
- **Amphipathic** = hydrophilic head, hydrophobic tail
- Hydrophobic barrier: keeps hydrophilic molecules out

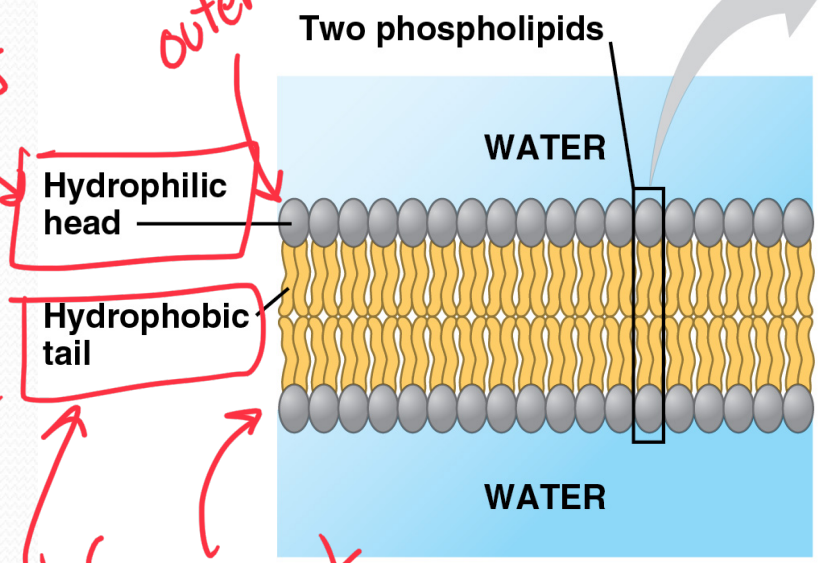
both

solubility

fat

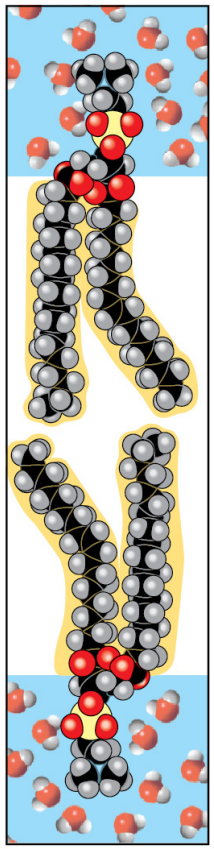
polar

outer leaflet



nonpolar

inner leaflet



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low → membrane gets too rigid

Membrane fluidity

phospholipids constantly move throughout membrane

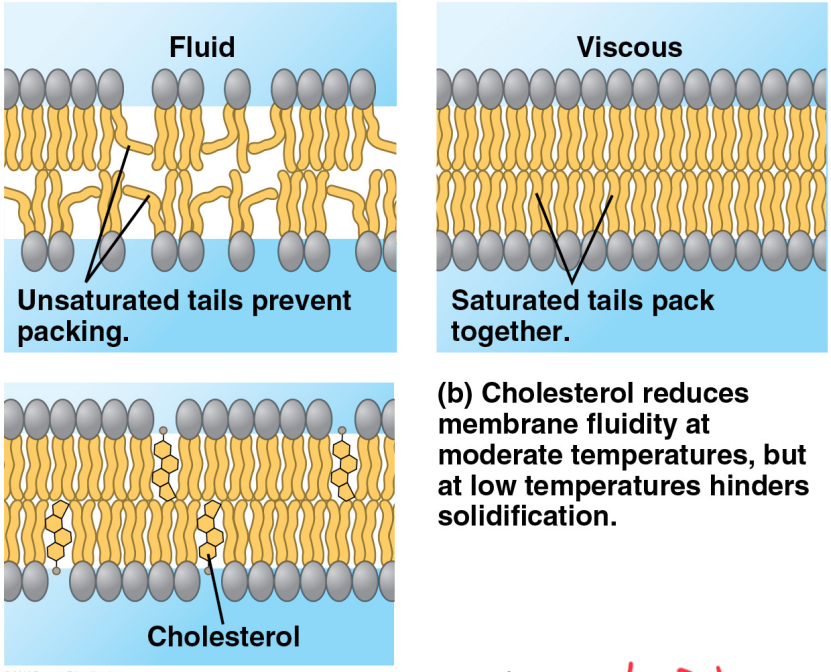
high → membrane too fluid

- **Low temps**: phospholipids w/ unsaturated tails (kinks prevent close packing)

→ temperature and fluidity

- **Cholesterol** resists changes by:
  - limit fluidity at high temps
  - hinder close packing at low temps

buffer



(a) Unsaturated versus saturated hydrocarbon tails.

(b) Cholesterol reduces membrane fluidity at moderate temperatures, but at low temperatures hinders solidification.

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High temp → loud/pulsating music

low temp → slow/soft

- Adaptations: bacteria in hot springs (unusual lipids); winter wheat (↑ unsaturated phospholipids)

Buffer → resists change

Membrane Proteins

Integral Proteins

- Embedded in membrane
- Determined by freeze fracture
- Transmembrane with hydrophilic heads/tails and hydrophobic middles

amphipathic

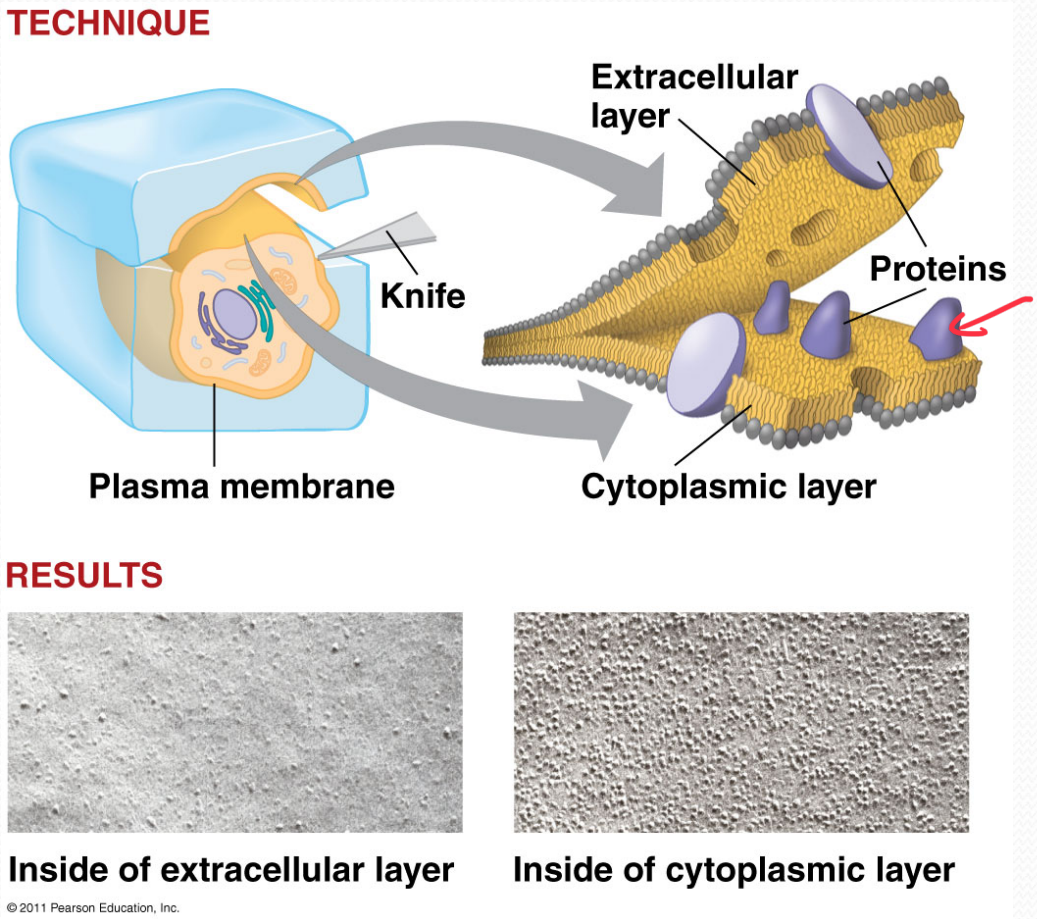
Peripheral Proteins

- Extracellular or cytoplasmic sides of membrane
- NOT embedded
- Held in place by the cytoskeleton or ECM

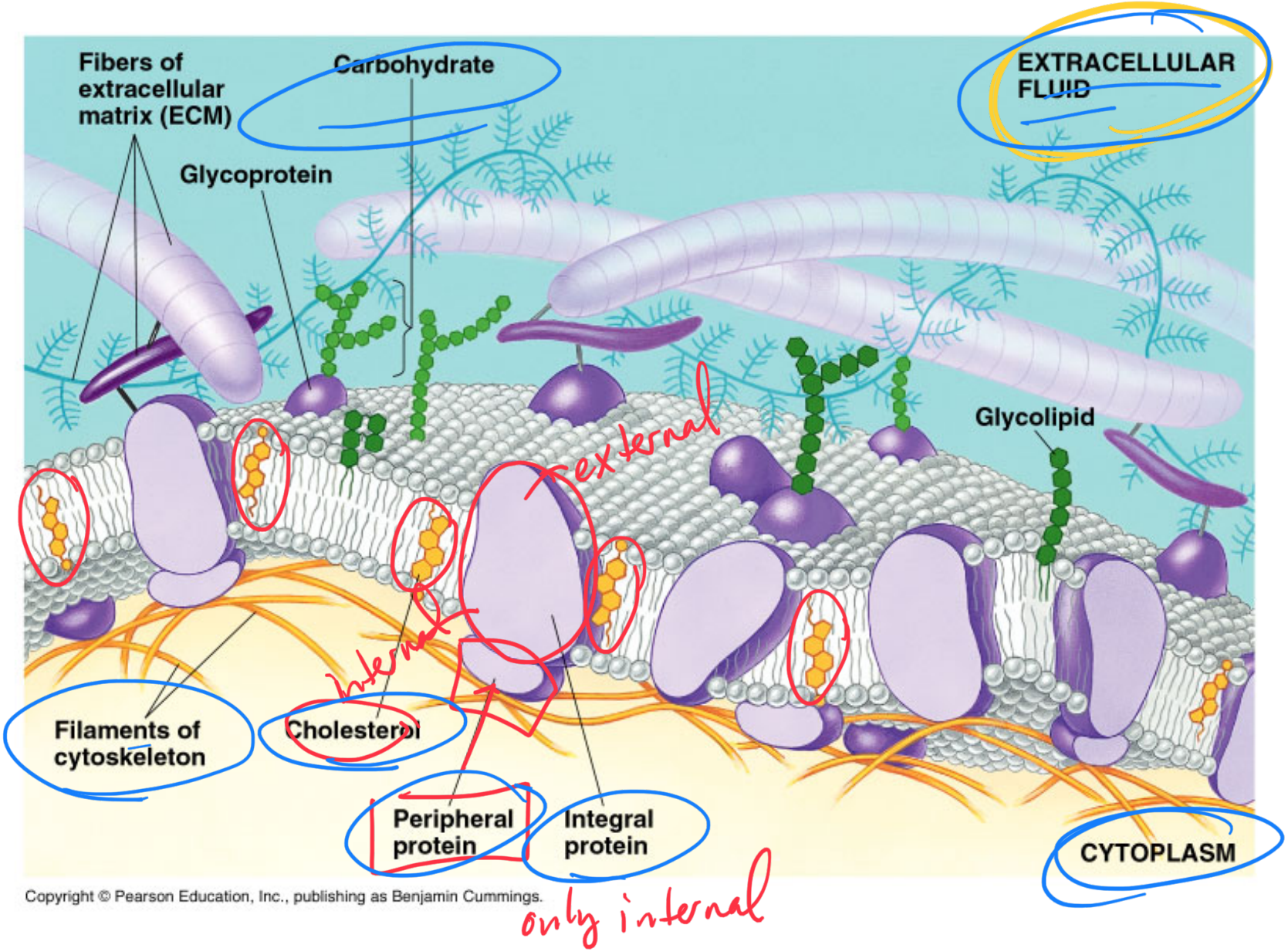
protein carbohydrate

- Provides stronger framework

The freeze-fracture method: revealed the structure of membrane's interior



integral membrane protein



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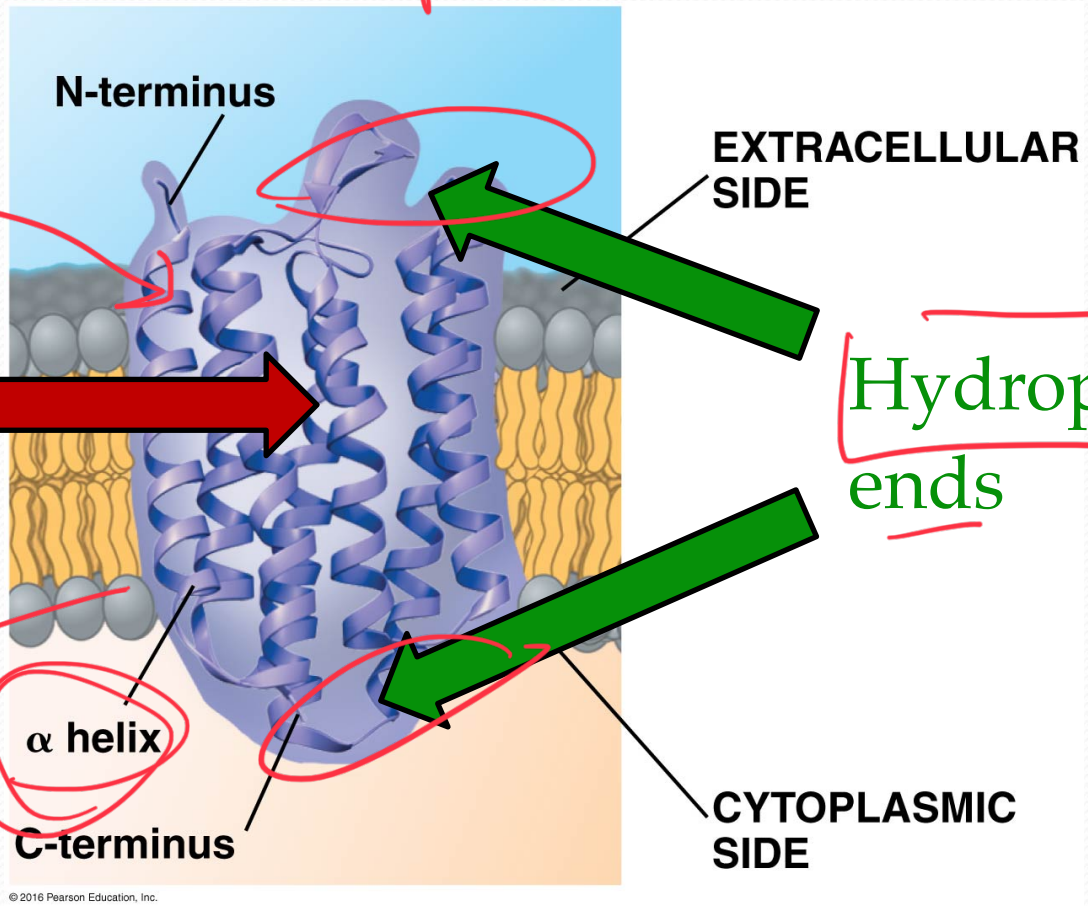
Integral & Peripheral proteins

Transmembrane protein structure

integral membrane → amphipathic

proteins α-helix

Hydrophobic interior



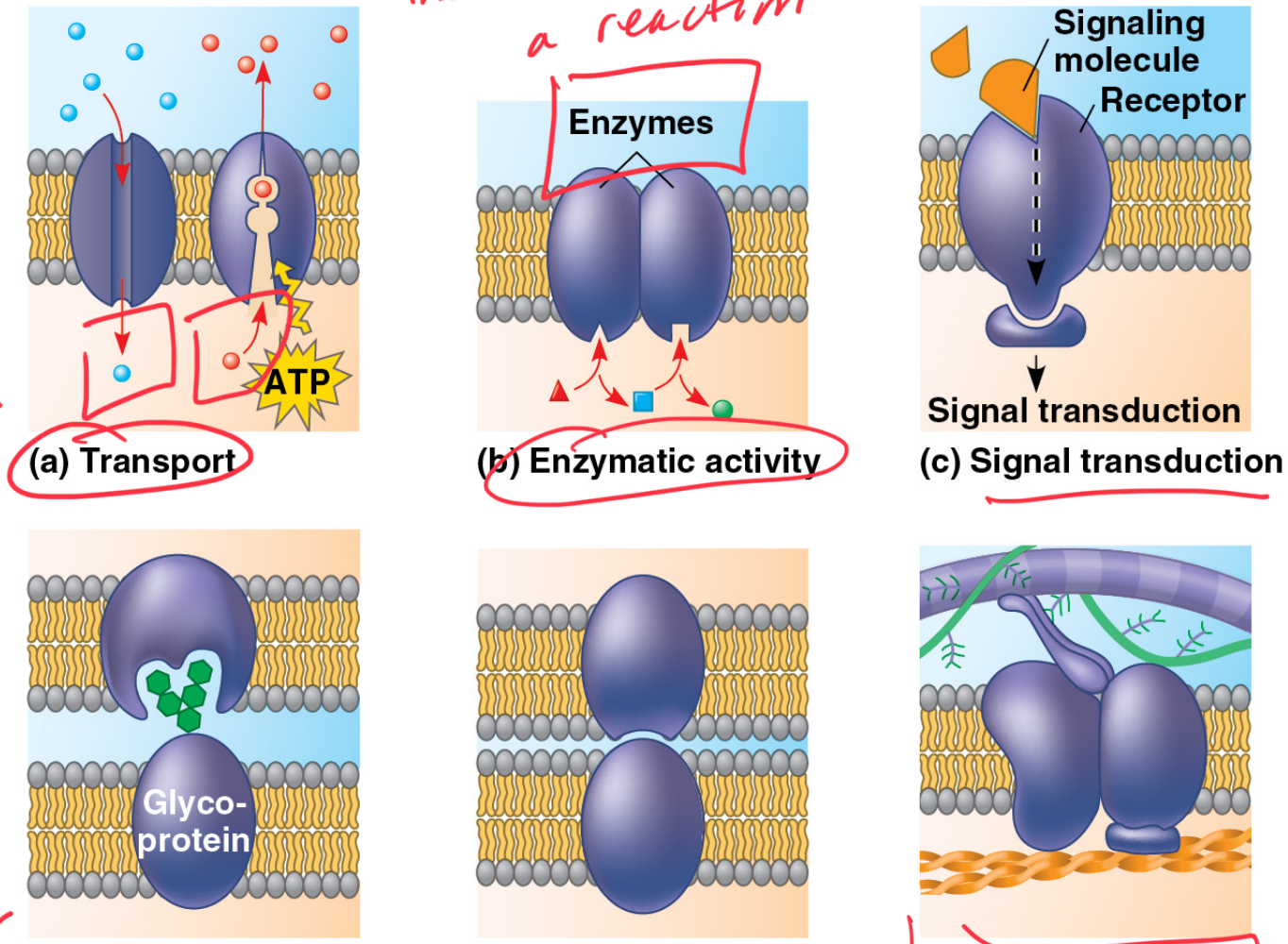
Hydrophilic ends

example of secondary protein structure

integral

Some functions of membrane proteins

increase the rate of a reaction



(a) Transport

(b) Enzymatic activity

(c) Signal transduction

(d) Cell-cell recognition

(e) Intercellular joining

(f) Attachment to the cytoskeleton and extra-cellular matrix (ECM)

blood type "self"

desmosome

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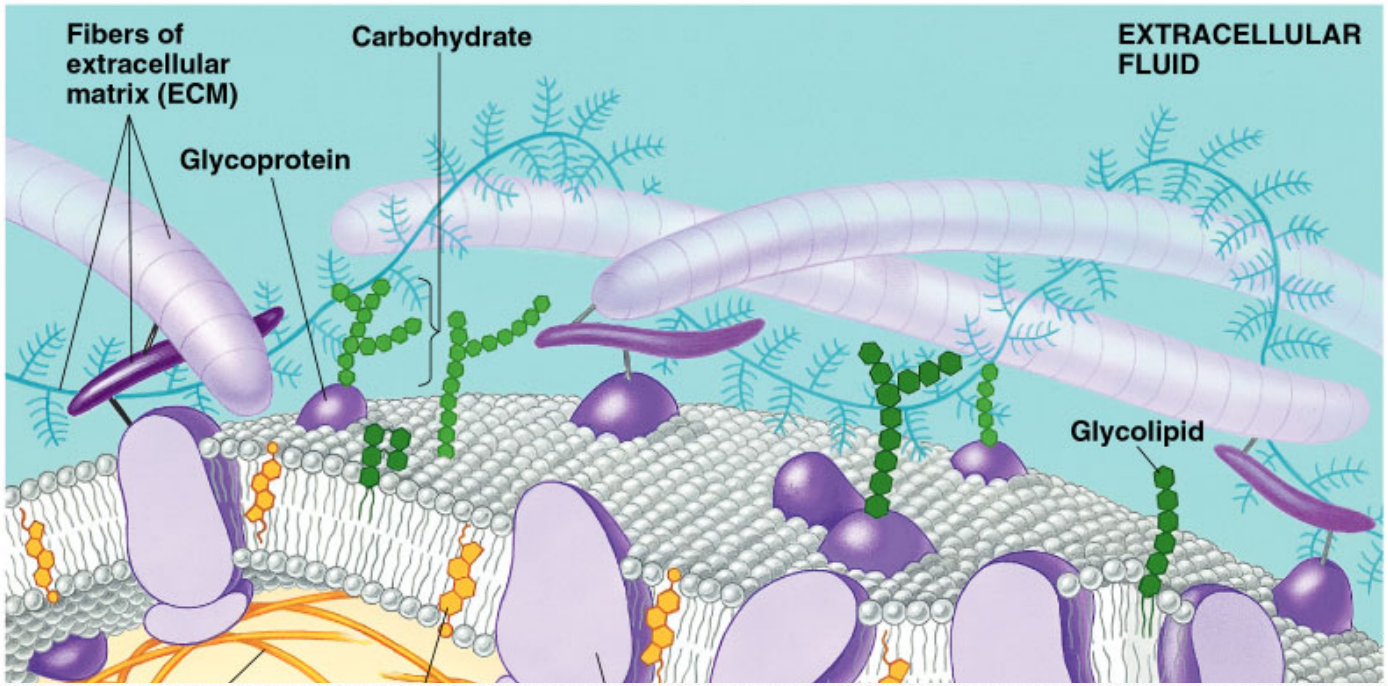
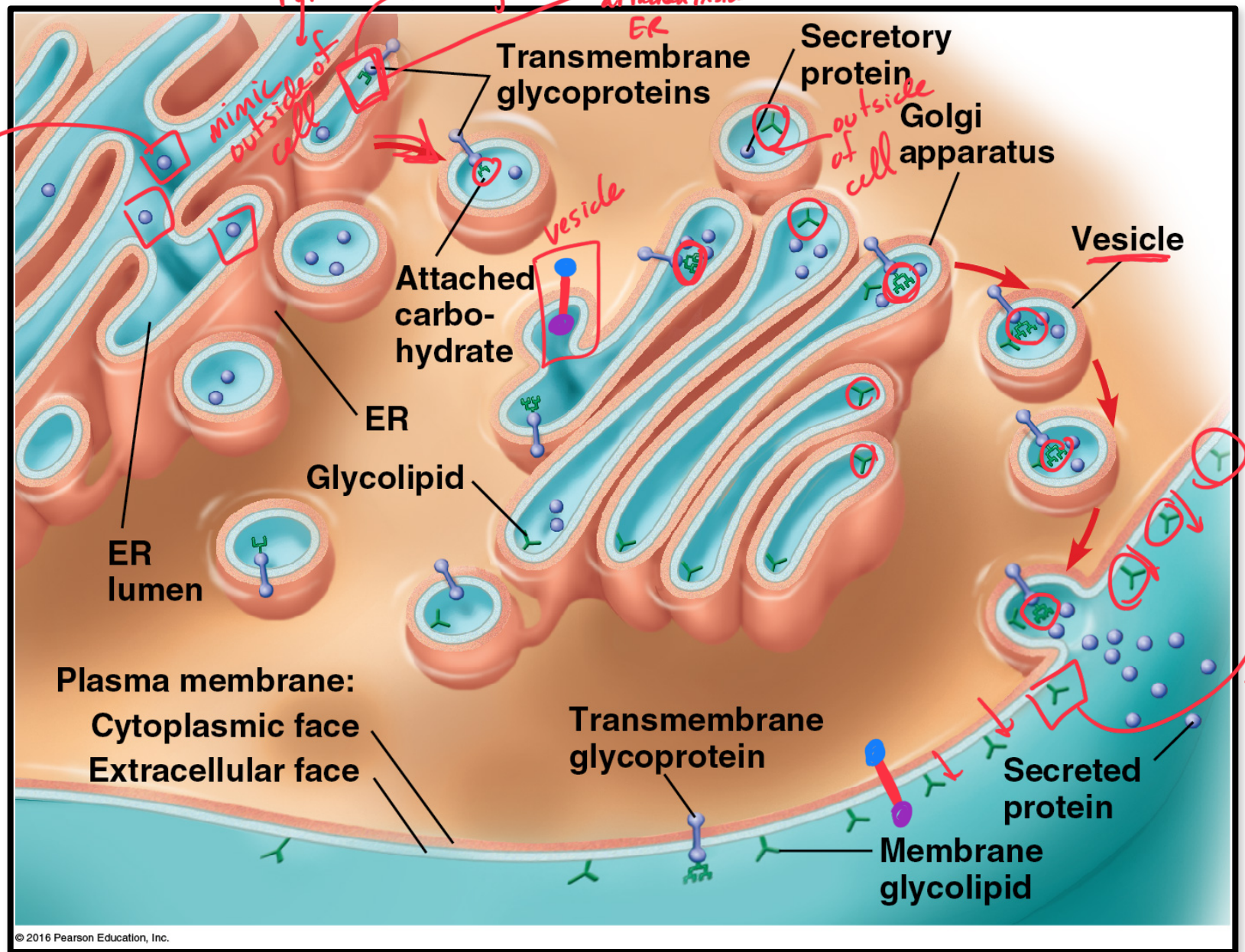
Carbohydrates

example: Blood type

- **Function**: cell-cell recognition; developing organisms
- Glycolipids, glycoproteins
- Eg. blood transfusions are type-specific



Synthesis and sidedness of membranes



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Selective Permeability

- **Small nonpolar molecules** cross easily: hydrocarbons, hydrophobic molecules, CO_2, O_2, N_2

  do not need protein intermediary

- **Polar uncharged molecules**, including H2O – pass in small amounts

  small

  if there is protein transport

- Hydrophobic core ***prevents*** passage of **ions, large polar molecules – movement through embedded channel and transport proteins**

Passive Transport

High concentration
↓
low concentration

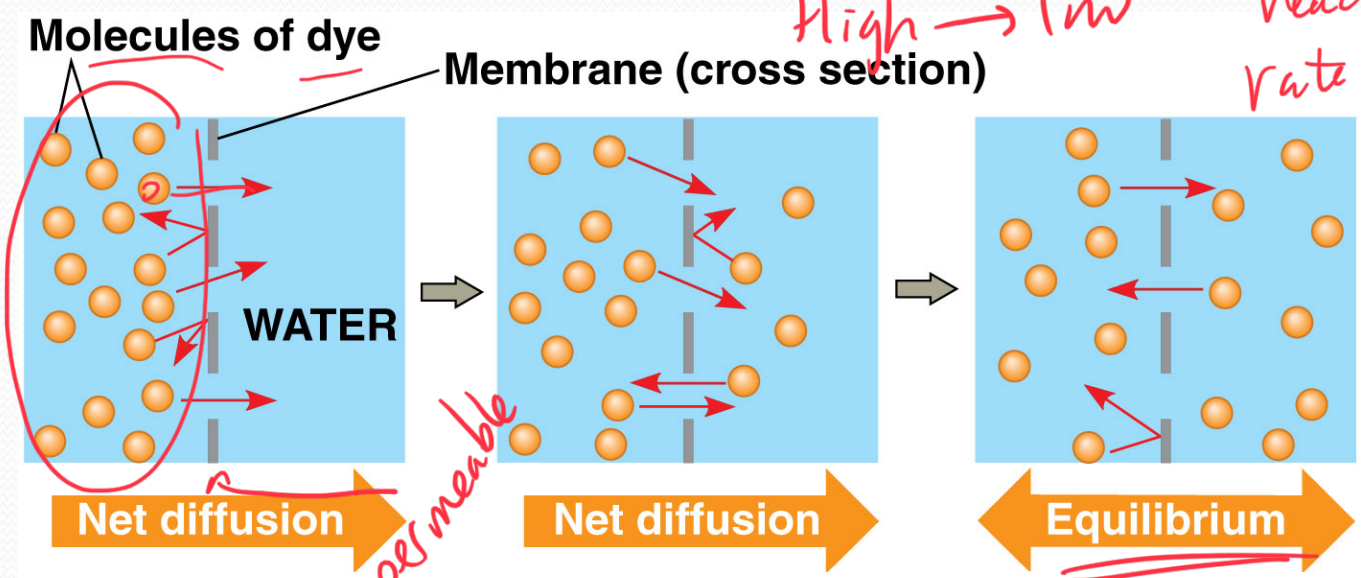
- NO ENERGY (ATP) needed!
- **Diffusion** *down* **concentration gradient** (high → low concentration)

Natural movement

Equilibrium → rate of the forward reaction equals rate of the reverse

- Eg. hydrocarbons, CO_2, O_2, H_2O

High → low



permeable

(a) Diffusion of one solute

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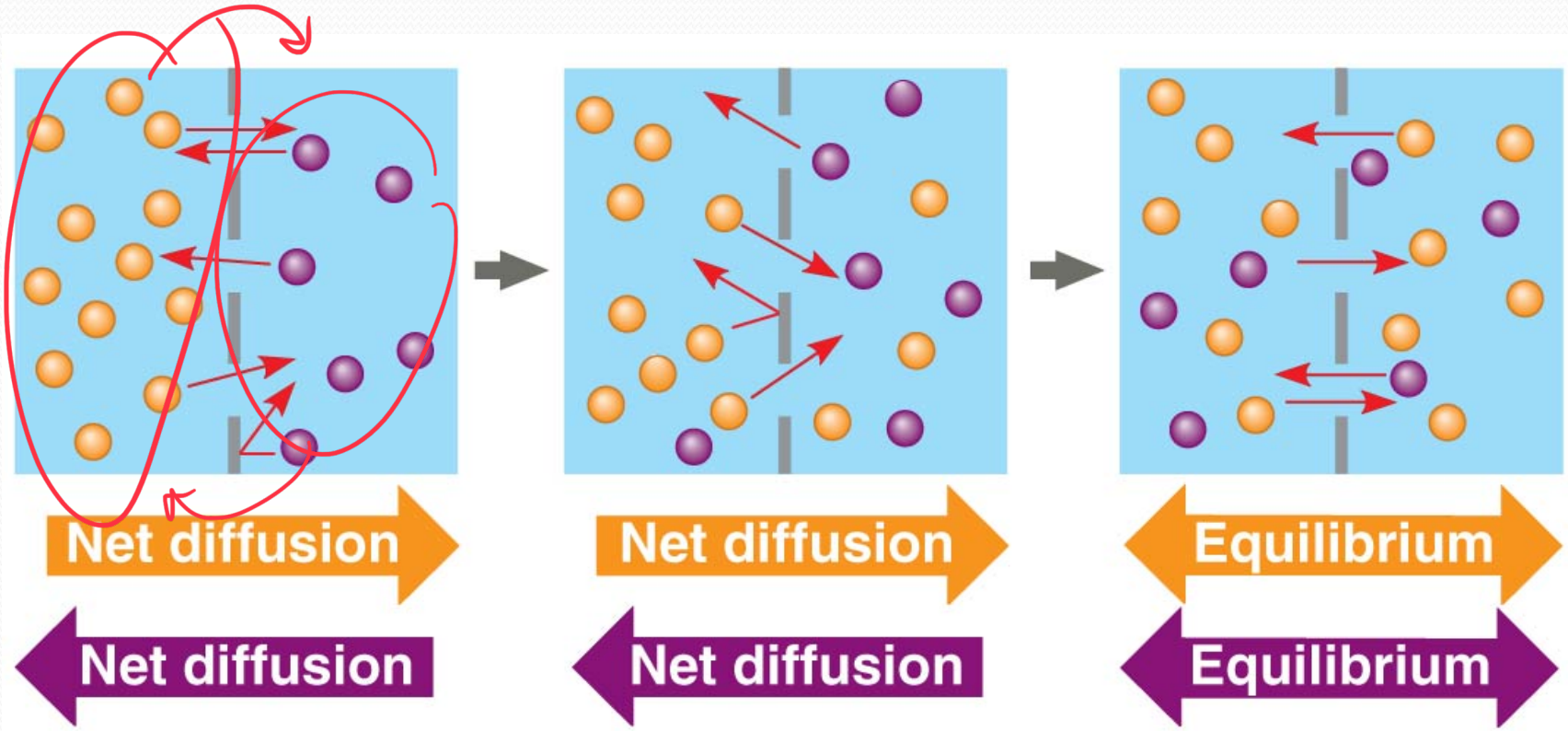
Does not mean equal

Diffusion



(b) Diffusion of two solutes

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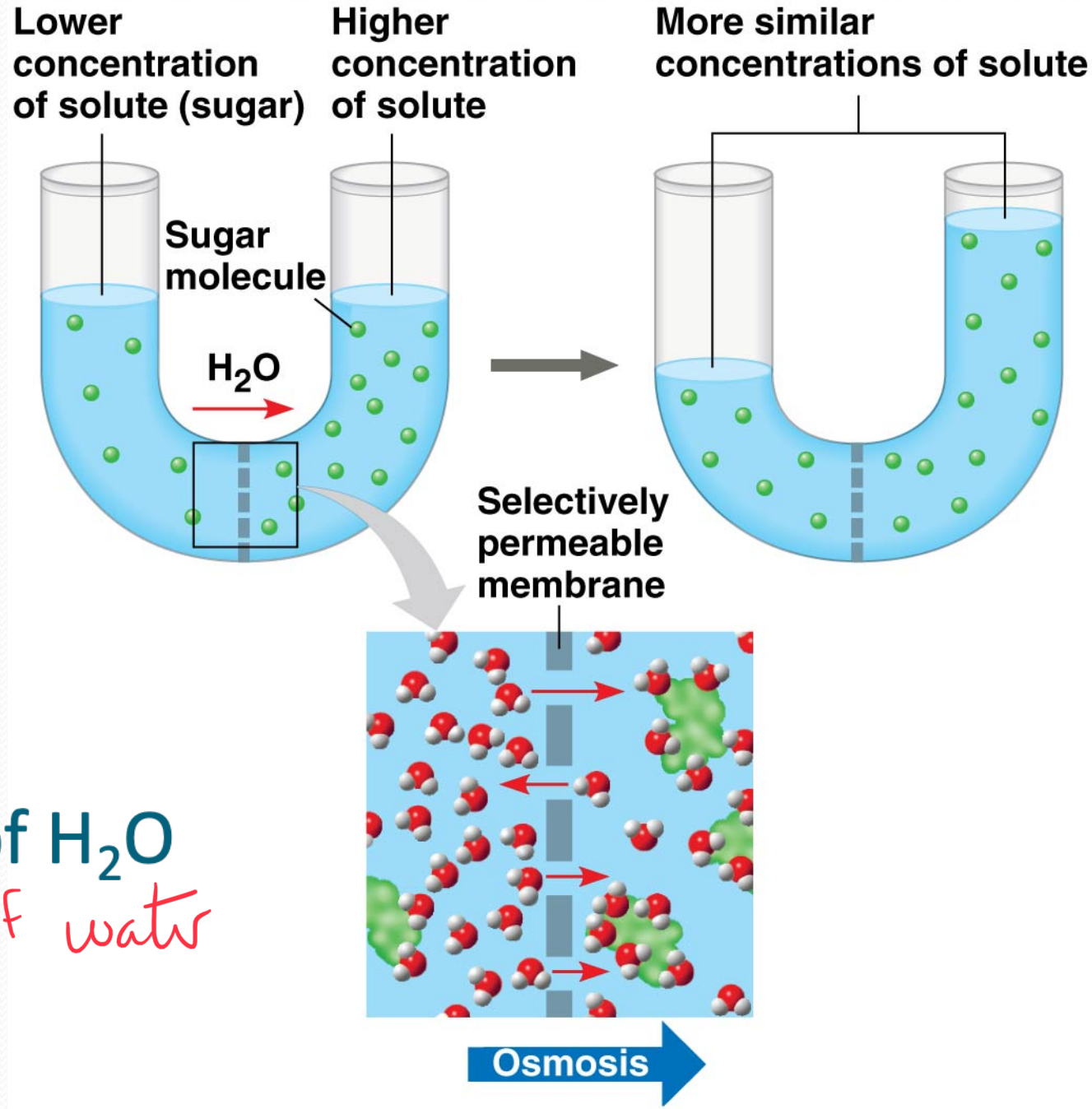

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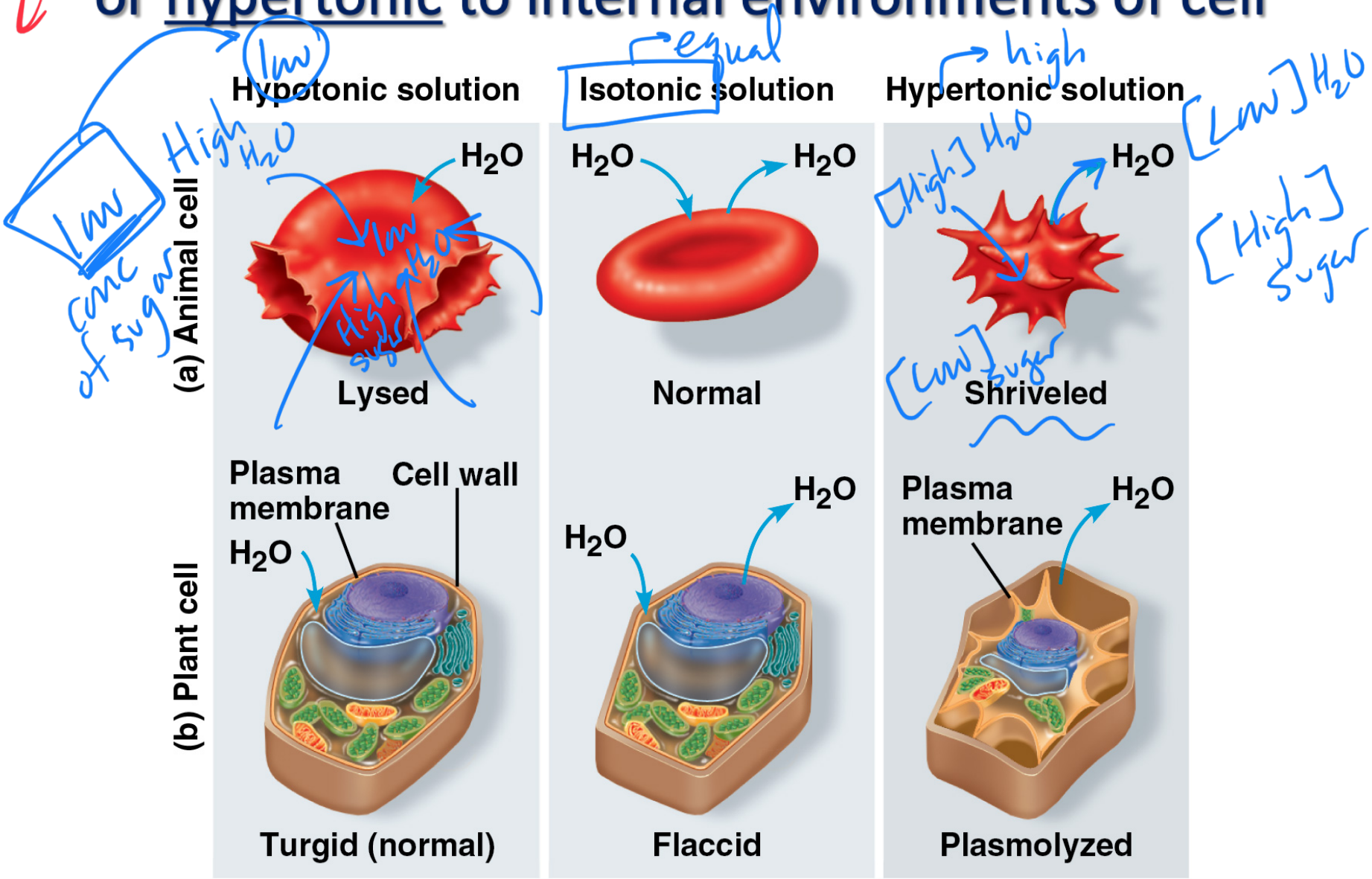
Osmosis:

diffusion of H_2O

movement of water

External environments can be hypotonic, isotonic or hypertonic to internal environments of cell



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