TRANSPORT ACROSSS CELL MEMBRANE

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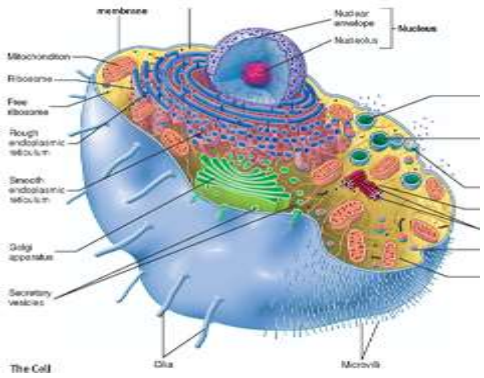
The basic living unit of the body is the cell. All cells use oxygen as one of the major substances from which energy is divided; the oxygen combines with carbohydrates, fat or protein to release the energy required for cell function.

General functions

Important to maintain a different environment **inside** the cell relative to **outside**-

-May not sound that interesting, but this is key to life: need to separate ion concentrations to create potential energy, preserve homeostasis.



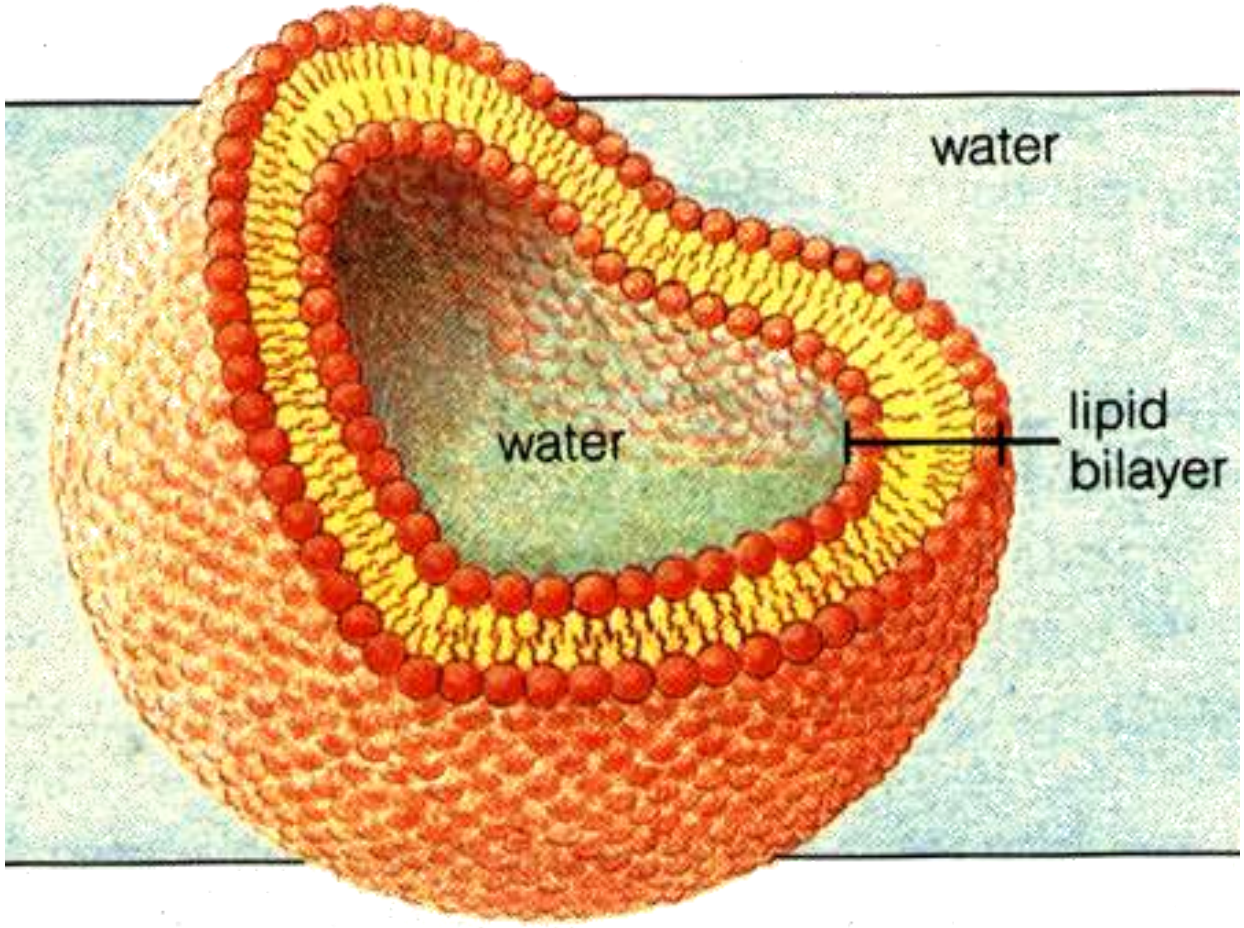
Structure of the cell membrane

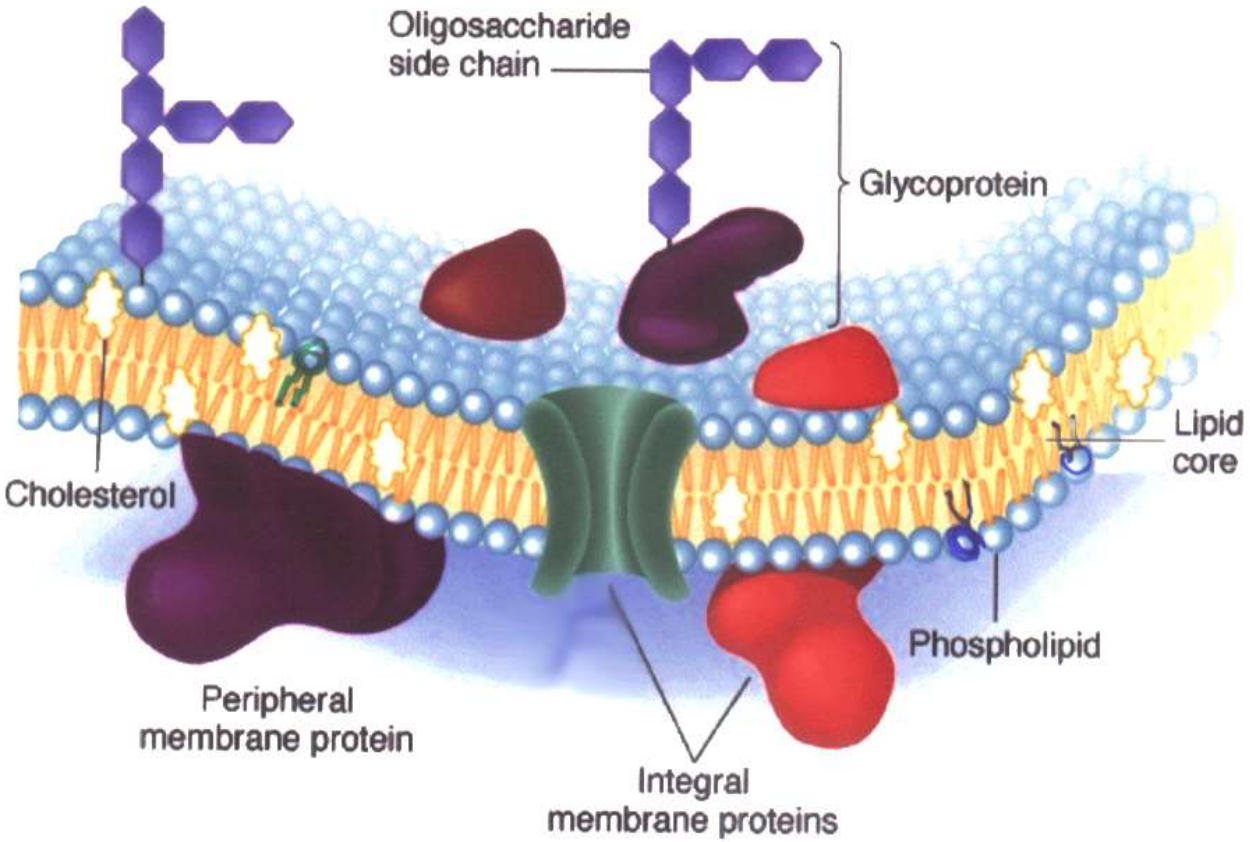
There are two types of fluids in the body , the fluids inside the cell is called intracellular fluid which is very different from that outside the cell which is called extracellular fluid .

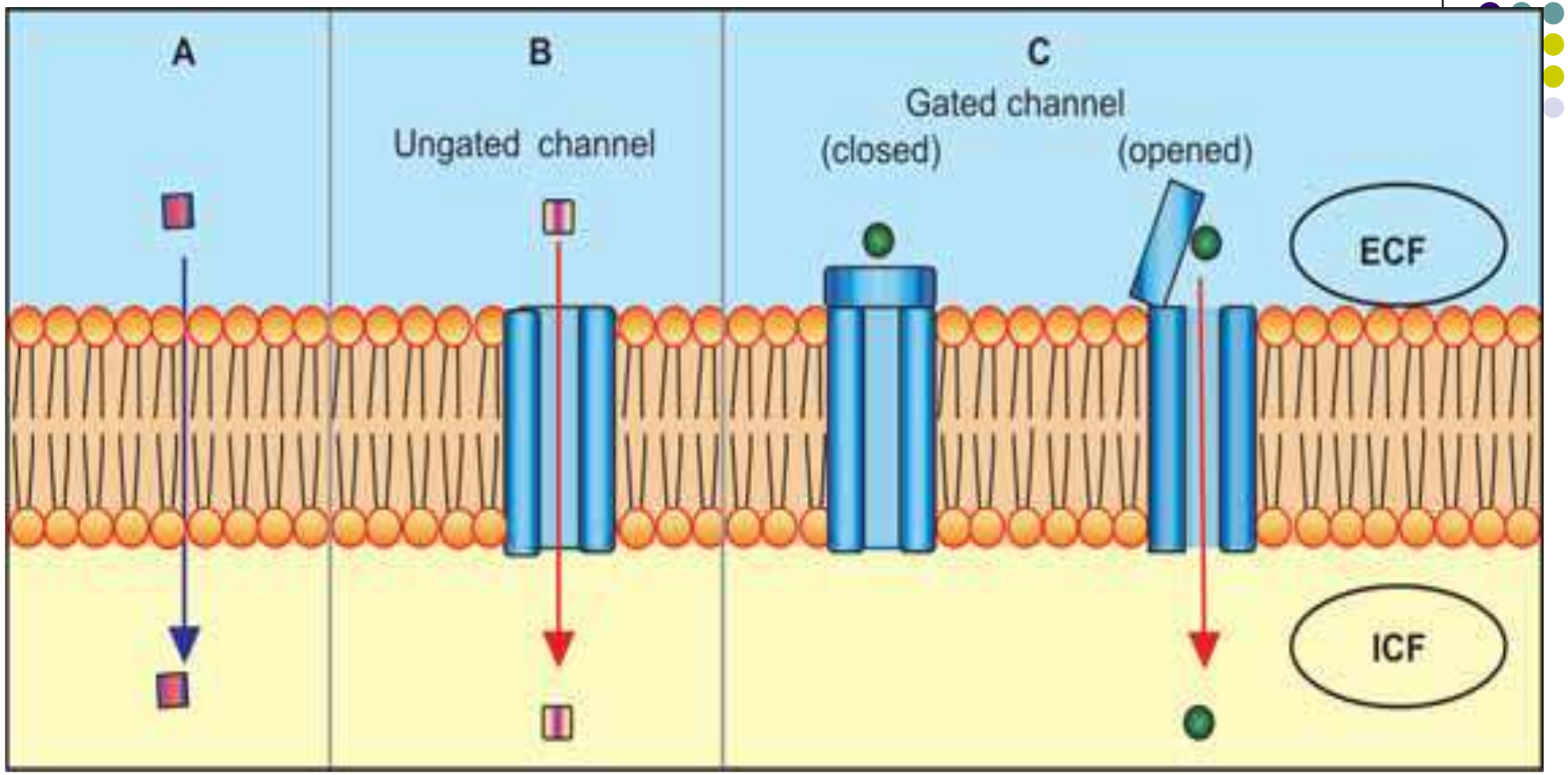
- Cell membrane separates intracellular fluids from extracellular fluids
- Contains lipids, proteins and carbohydrates
  - Lipids
    - Phospholipids
    - Cholesterol
  - Proteins
    - Integral
    - Peripheral
  - Carbohydrates
    - Form the glycocalyx

Cell Membrane

Plasma membrane encloses cell and cell organelles




Oligosaccharide
side chain
Glycoprotein
Lipid
core
Cholesterol
Phospholipid
Peripheral
membrane protein
Integral
membrane proteins

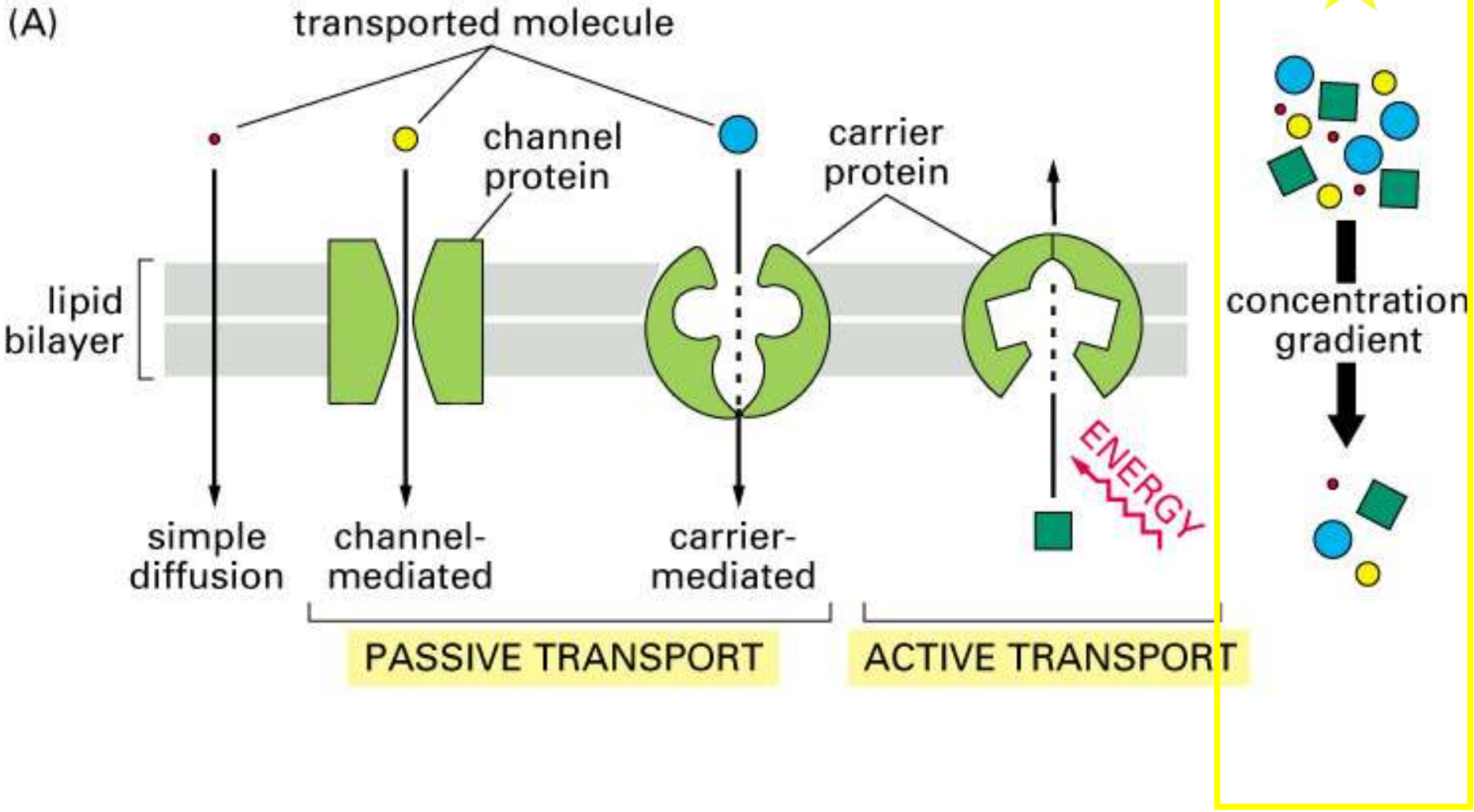


Hypothetical diagram of simple diffusion through the cell membrane. A = Diffusion through lipid layer. B = Diffusion through ungated channel. C = Diffusion through gated channel

Crossing the membrane

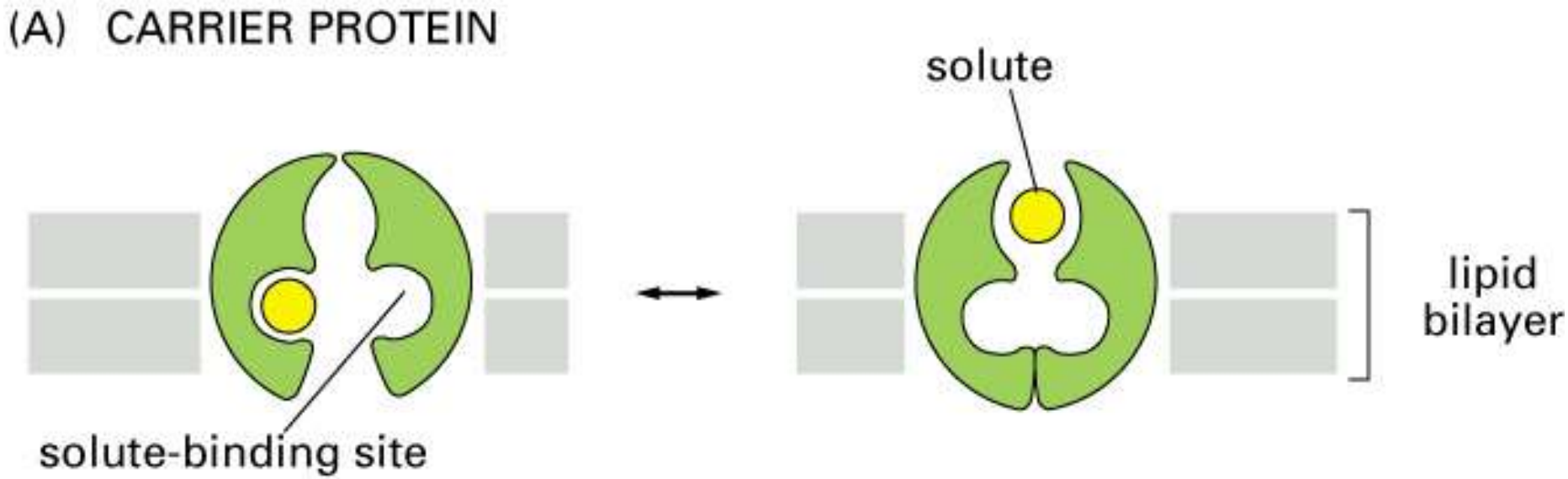
- Simple or passive diffusion
- Passive transport
  - Channels or pores
- Facilitated transport
  - Assisted by membrane-floating proteins
- Active transport pumps & carriers
  - ATP is required
  - Enzymes and reactions may be required

Modes of Transport



Carrier-Mediated Transport

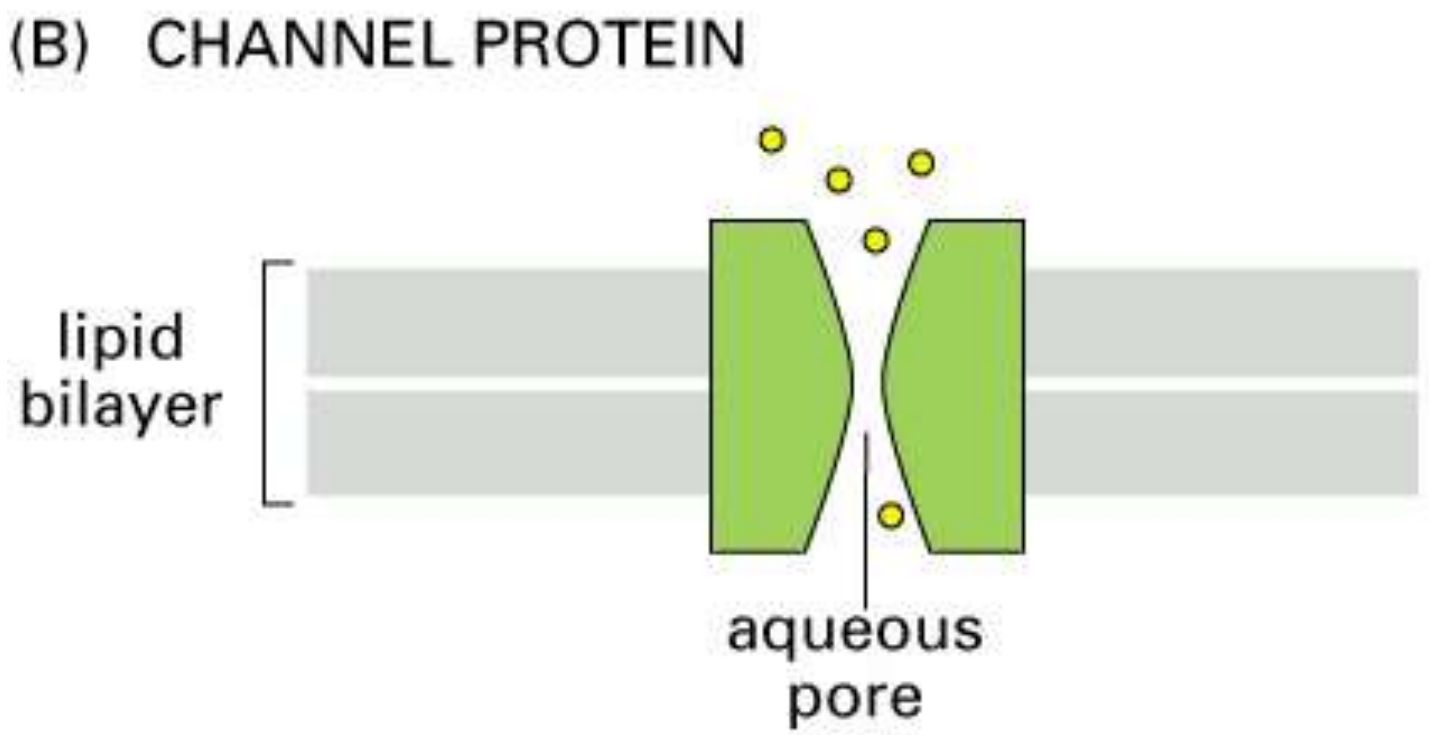
- Integral protein binds to the solute and undergo a conformational change to transport the solute across the membrane




(Figure 4-21, pg 93)

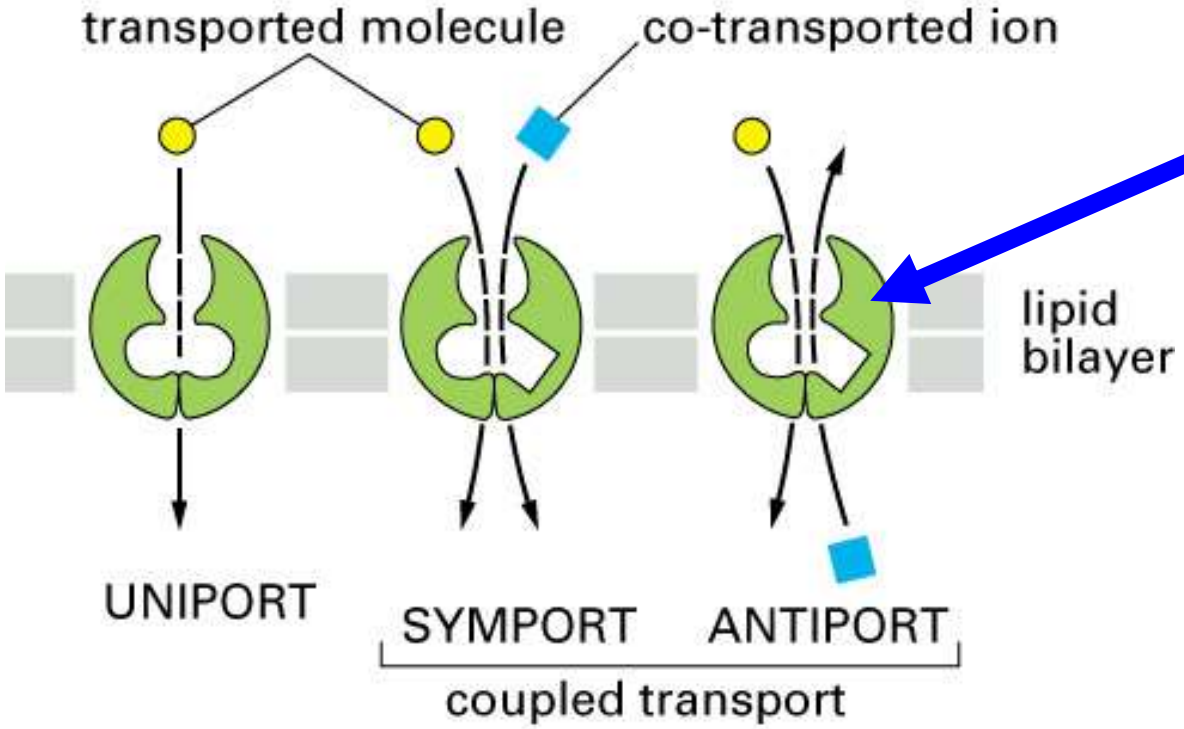
Channel Mediated Transport

- Proteins form aqueous pores allowing specific solutes to pass across the membrane
- Allow much faster transport than carrier proteins



Coupled Transport

- Some solutes “go along for the ride” with a carrier protien or an ionophore



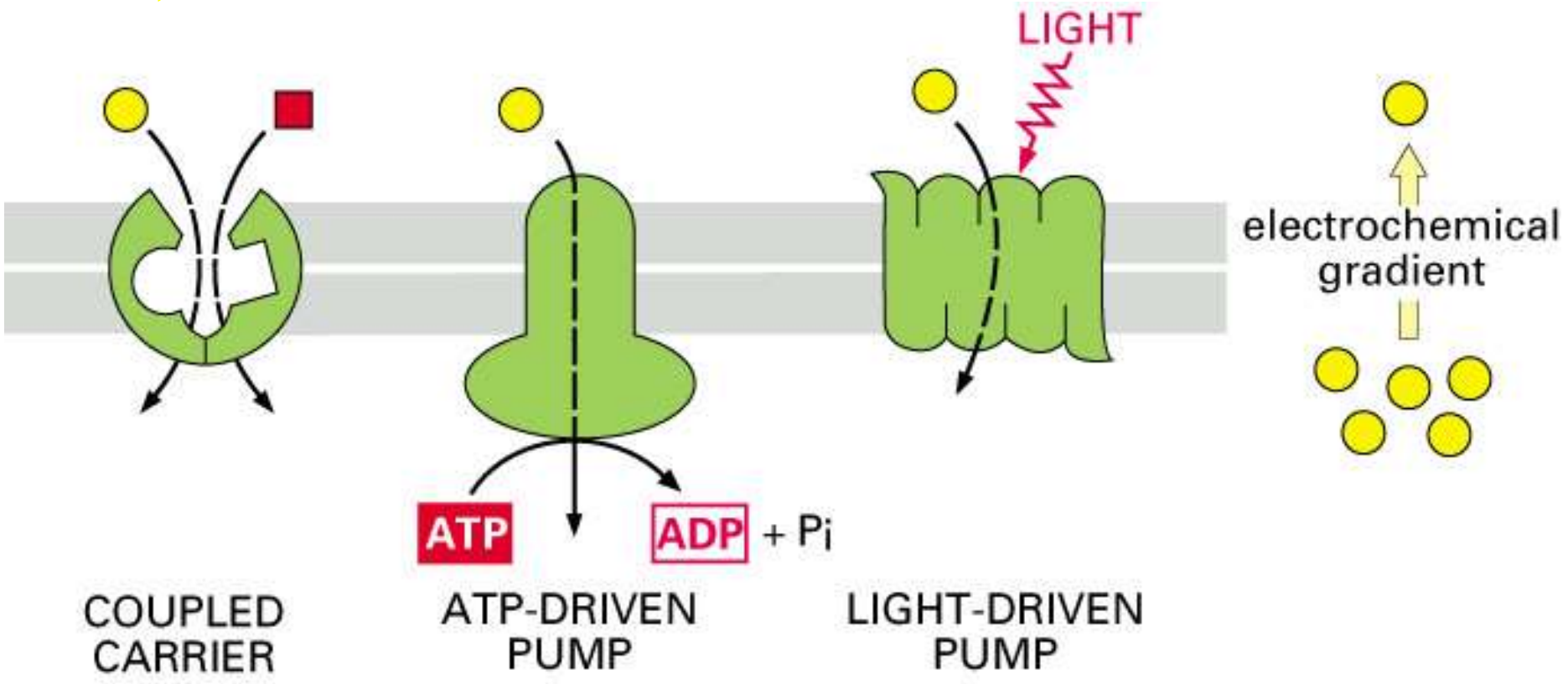
Can also be a Channel coupled transport

Active transport

- Three main mechanisms:
  - coupled carriers: a solute is driven uphill compensated by a different solute being transported downhill (secondary)
  - ATP-driven pump: uphill transport is powered by ATP hydrolysis (primary)
  - Light-driven pump: uphill transport is powered by energy from photons (bacteriorhodopsin)

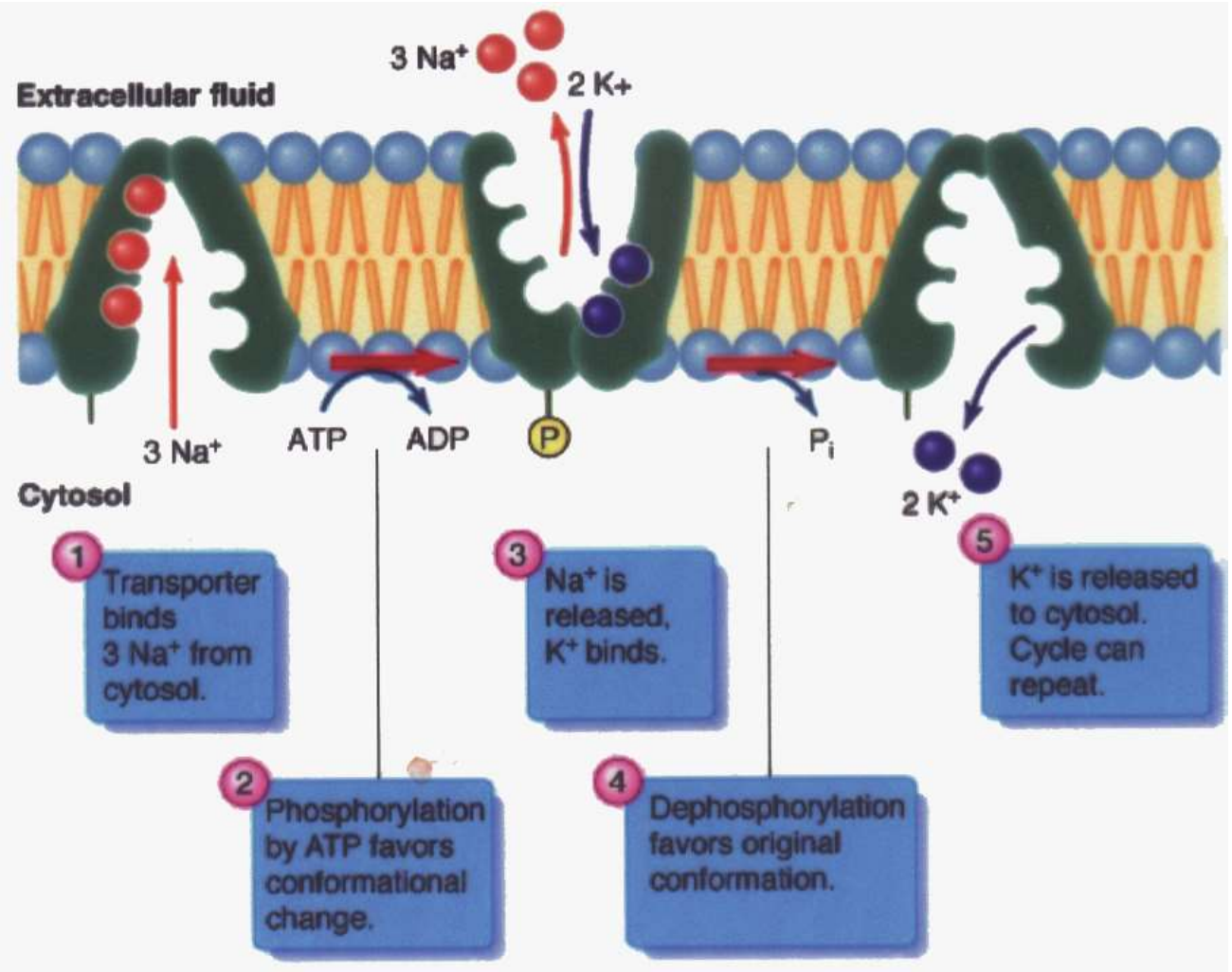
Active transport

- Energy is required

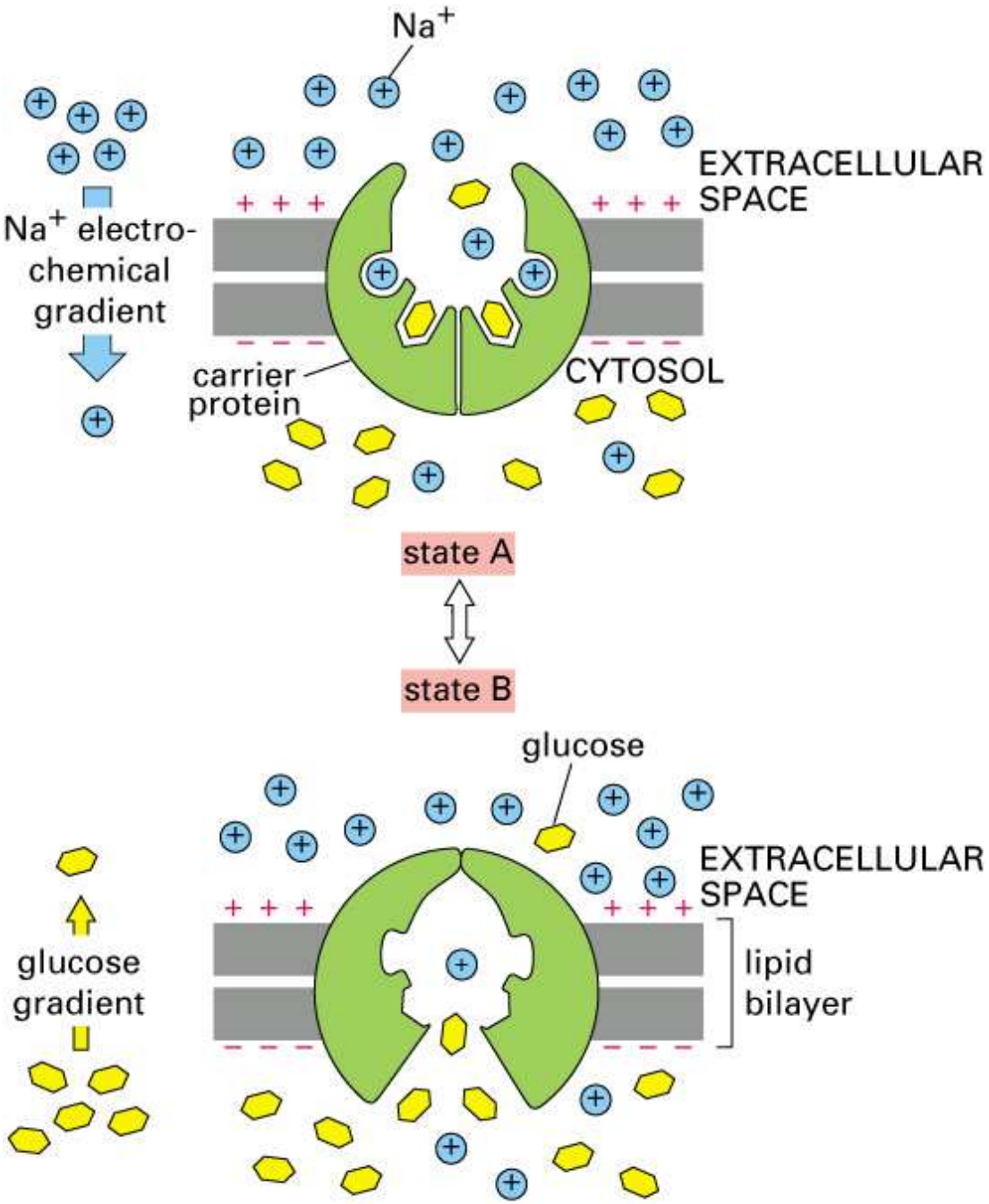


Na^+/K^+ Pump

- Actively transport Na+ out of the cell and K+ into the cell



- Against their electrochemical gradients
- For every 3 ATP, 3 Na+ out, 2 K+ in


Na+
EXTRACELLULAR SPACE
Na+ electro-chemical gradient
carrier protein
CYTOSOL
state A
state B
glucose
EXTRACELLULAR SPACE
glucose gradient
lipid bilayer

Endo and Exocytosis

- Exocytosis

  - membrane vesicle fuses with cell membrane, releases enclosed material to extracellular space.

- Endocytosis

  - cell membrane invaginates, pinches in, creates vesicle enclosing contents