

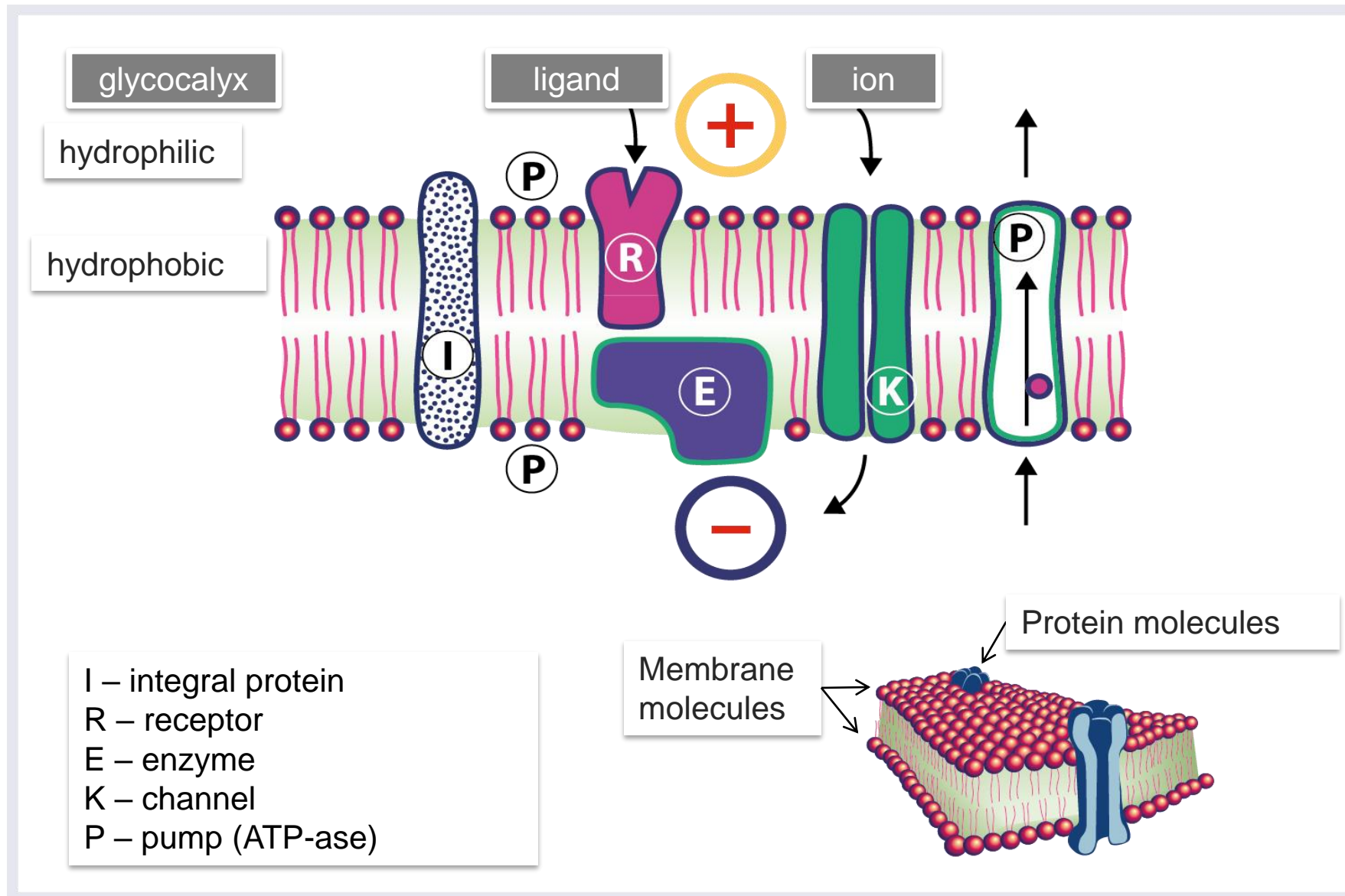
**M U N I  
M E D**

**Structural and functional organisation of  
the living systems.**

**Homeostasis.**

*Life is a dynamic system with focused behavior, with autoreproduction, characterized by **flow of substrates, energies and information.***

# PLASMATIC MEMBRANE



## COMPARTMENTALISATION OF BODY FLUIDS

GIT, lungs, kidney, skin

}	Plasma	5% - 3,5 litres	<i>Evans blue, <sup>131</sup>J</i>
	Interstitial fluid	15% - 10,5 litres	<i>Inulin, manitol, sacharose</i>
	Intracellular fluid	40% - 28 litres	<i>Antipyrin, D<sub>2</sub>O</i>

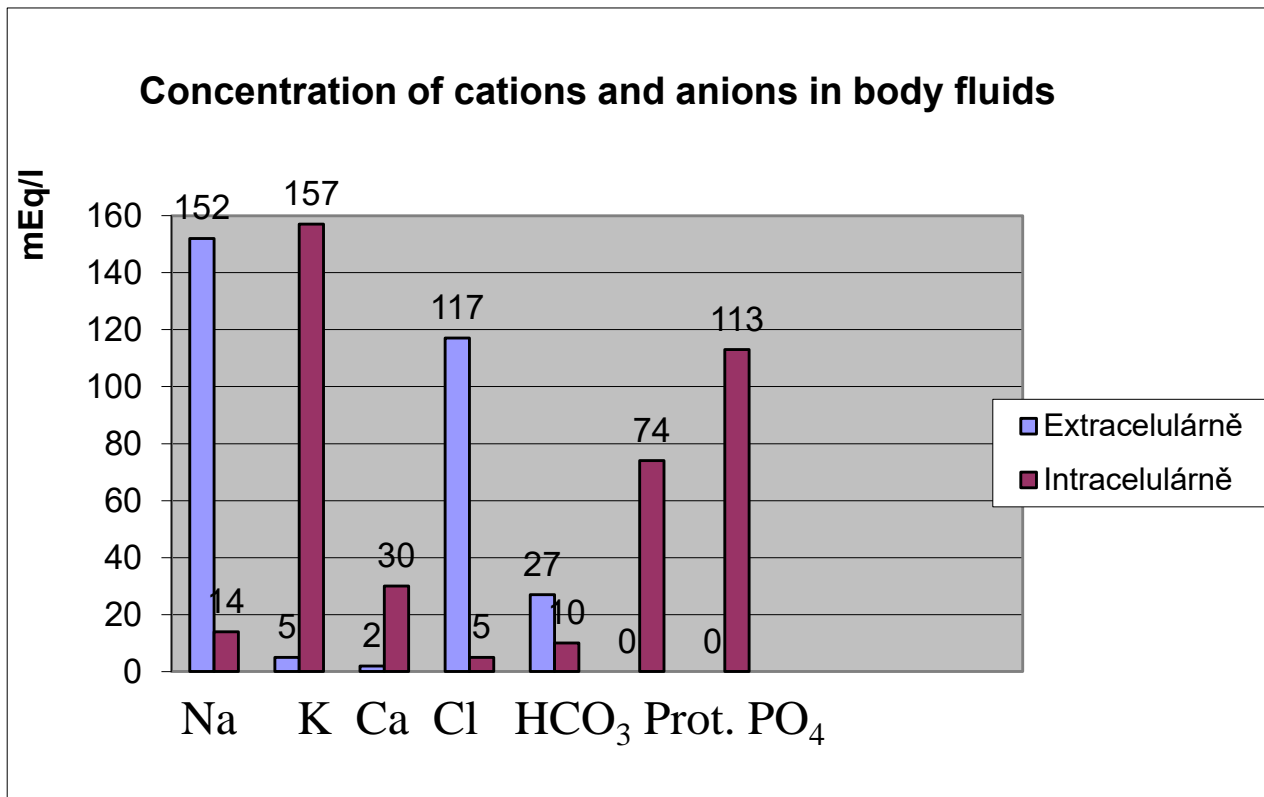
**Extracellular fluid (incl. plasma)**

**Total volume of fluids**

# BODY FLUIDS

## BODY COMPOSITION

Water	60% (80-50%) of body mass
Proteins	18%
Lipids	15%
Minerals	7%



# TRANSPORT MECHANISMS

**PASSIVE**

**REGULATED**

**ACTIVE**

**DIFFUSION**

**FACILITATED DIFUSION**

**ATP-ases**

**OSMOSIS**

**COTRANSPORT**

**SYMPORT**

**FILTRATION**

**ANTIPOINT**

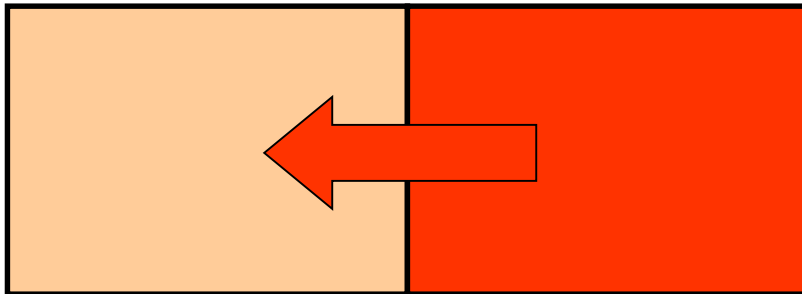
# PASSIVE TRANSPORT MECHANISMS

Differences in body fluids composition result from features of barriers and forces responsible for transport.

## DIFUSION

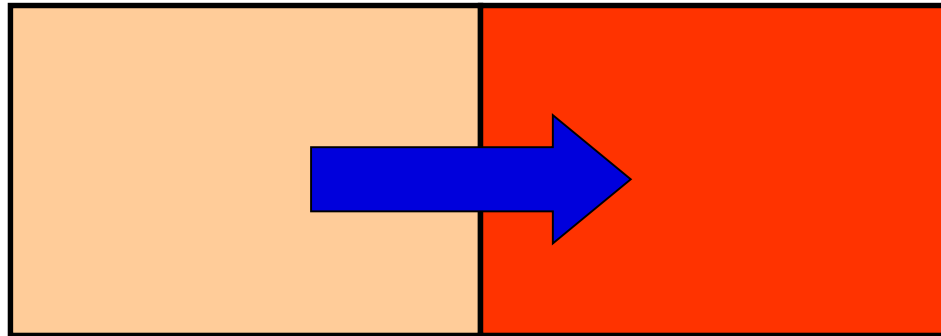
Transport of gases, substrates, metabolites (up to m.w. 60 thous. in direction of concentration gradient of diluted compound.

It depends on solubility in water and lipids.



# OSMOSIS

Transport of water across semipermeable membrane in direction to higher concentration of diluted compound (e.g. in direction to lower concentration of water). It depends on number of particles.



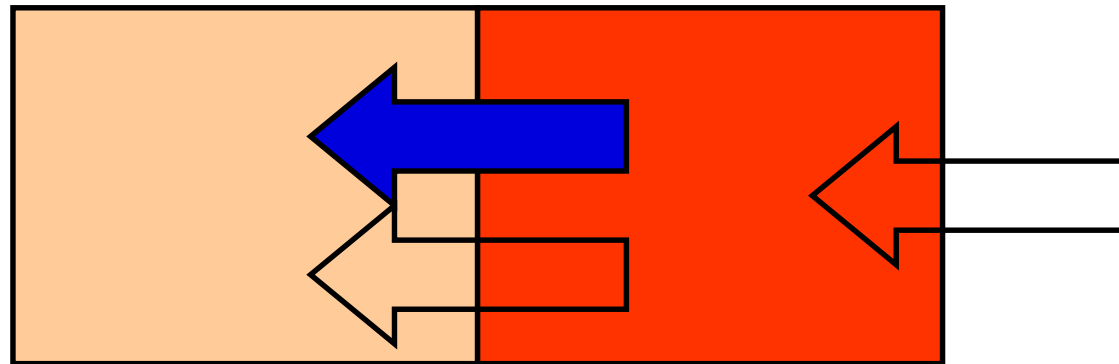
Examples: .....



# FILTRATION

Movement of solvent as a result of osmotic and hydrostatic pressure.

Production and resorption of interstitial fluid (**Starling forces**).



## REGULATED TRANSPORTS

### FACILITATED DIFUSION

selective carrier  
limited capacity

amino acids  
phosphate

### COTRANSPORT

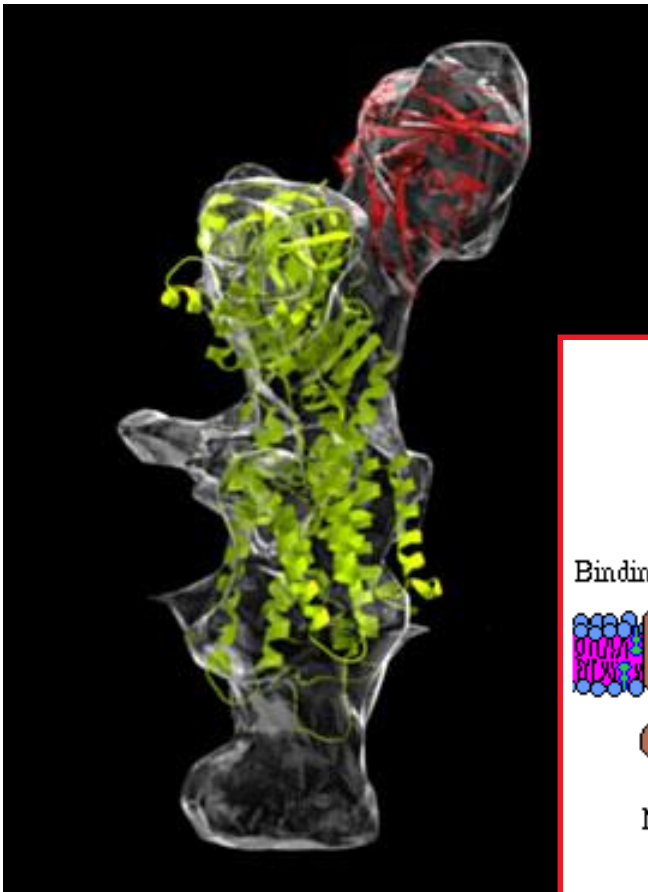
transported compound uses concentration  
gradient of  $\text{Na}^+$  as the driving force

**SYMPORT** in the same direction

**ANTIPOINT** in opposite direction

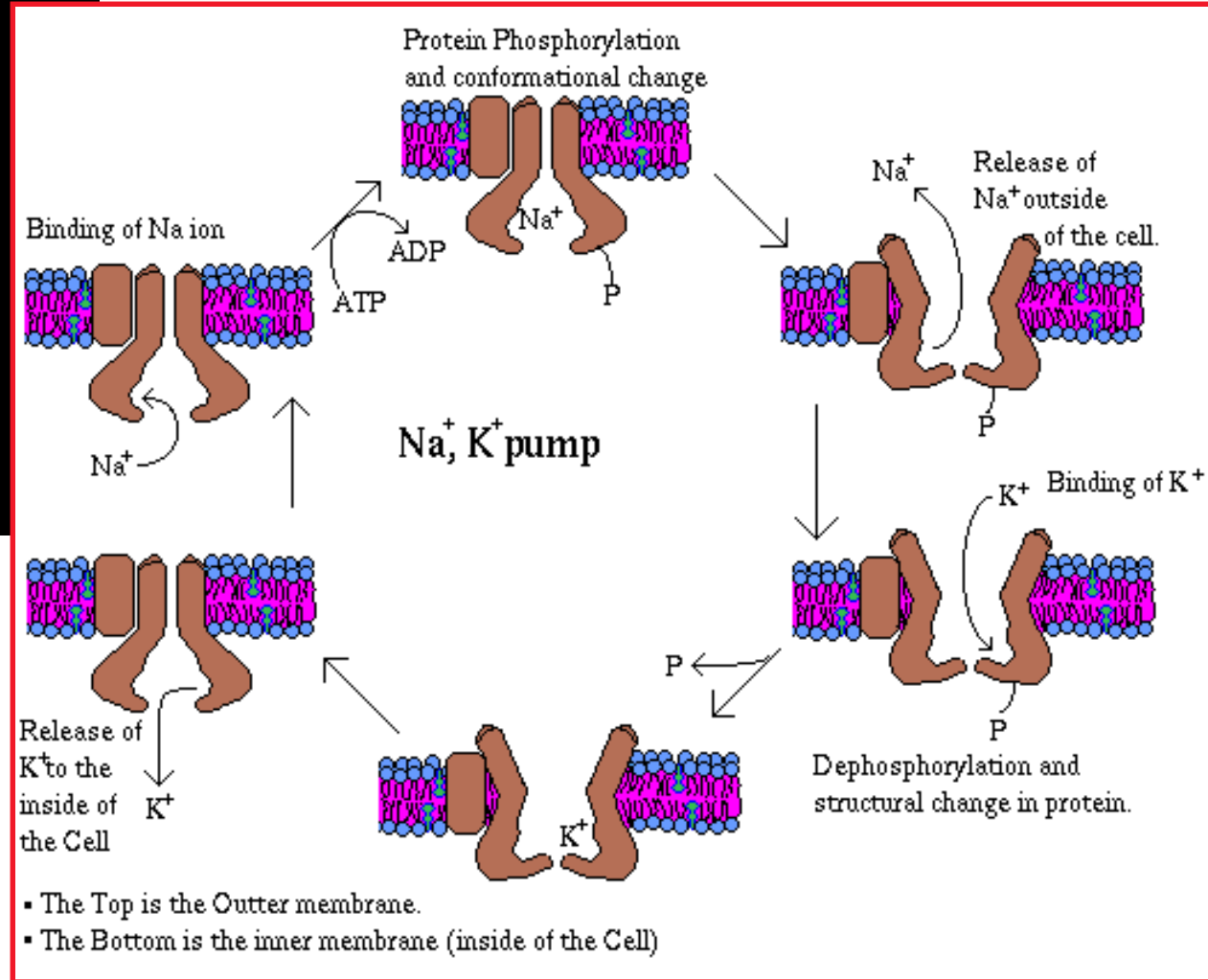
glucose, AMK

$\text{Ca}^{2+}$ ,  $\text{H}^+$



# ACTIVE TRANSPORTS

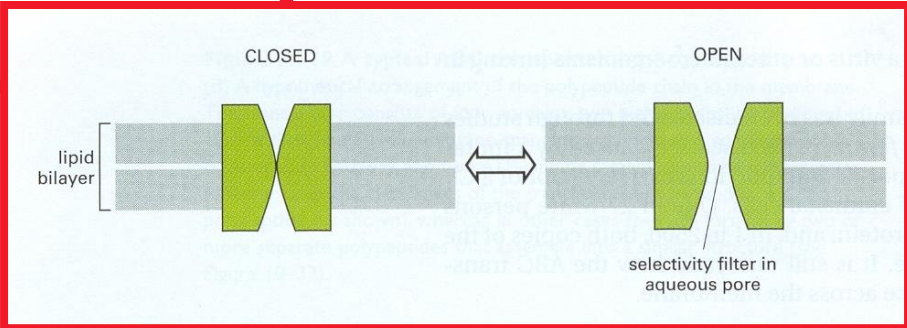
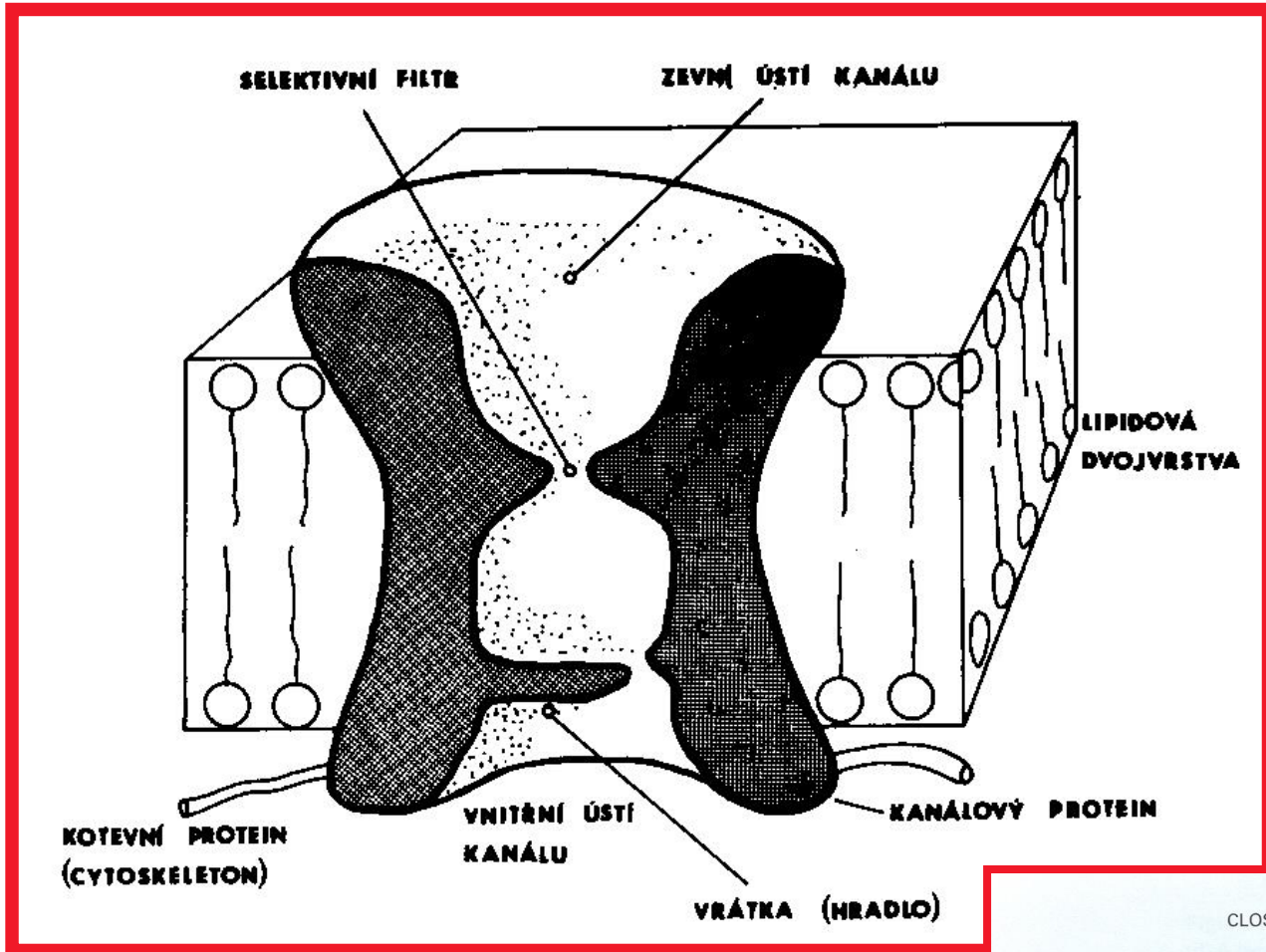
Na<sup>+</sup>/K<sup>+</sup> ATP-ase (exchanger)  
**AGAINST** concentration gradient



Similar transports:

- Ca<sup>2+</sup>/H<sup>+</sup>
- Na<sup>+</sup>/K<sup>+</sup>
- K<sup>+</sup>/H<sup>+</sup>
- Na<sup>+</sup>/H<sup>+</sup>

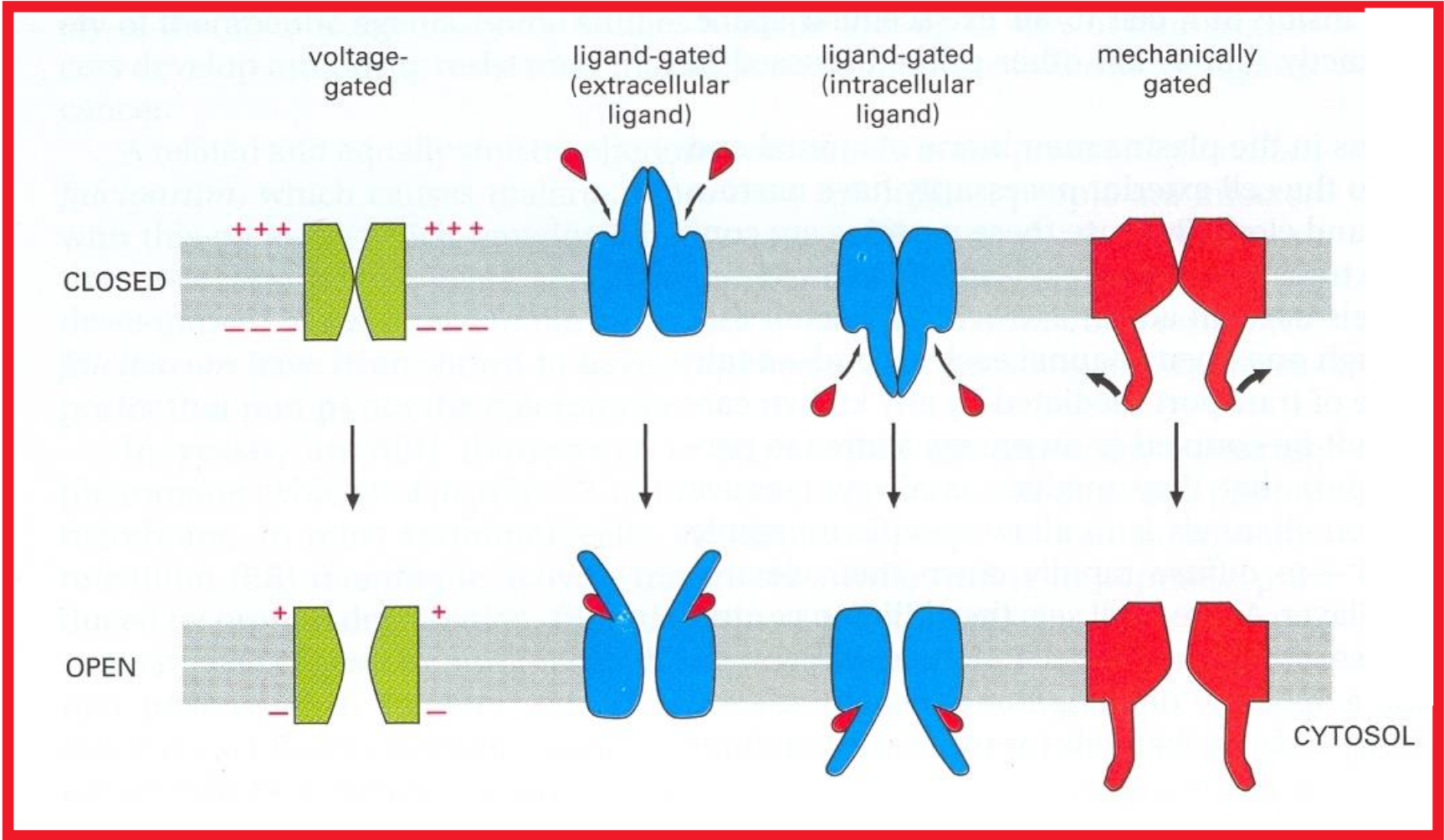
# IONIC CHANNEL



Membránová elektrofyziologie myokardu, P. Pučelík, Avicenum, 1990

Molecular biology of the cell. B. Alberts et al., Garland Science 2002

# GATING



# COMMUNICATION AMONG THE CELLS

## MECHANICAL CONNECTION

- desmosomes (macula adherens; cell adhesion and mechanical stability of tissues) – epidermis, liver, myocardium

## ELECTRICAL CONNECTION

- gap junction (nexus) (in intercalar disc; consists of connexons)

## HUMORAL CONNECTIONS (REGULATION)

- autocrine
- paracrine
- endocrine
- juxtacrine
- neurocrine
- neuroendocrine

Receptor, ligand, second messenger

## NERVOUS CONNECTIONS (REGULATION)

## **INTEGRATION OF HUMORAL AND NERVOUS SYSTEMS:**

- synapse
- hypothalamus - pituitary gland
- adrenal medulla

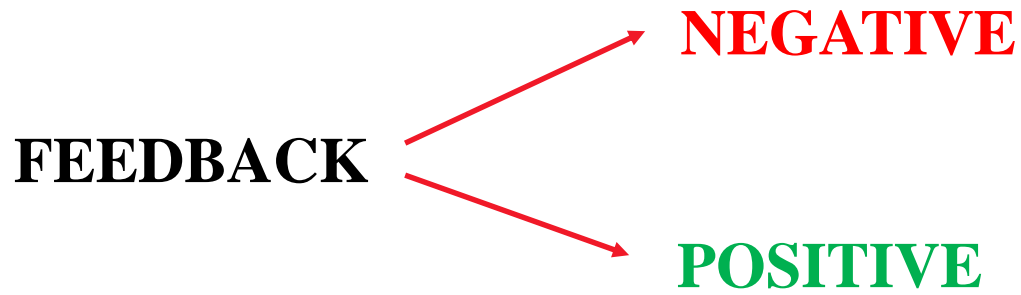
# REGULATION

Control of living systems.

Living systems – open systems; their existence depends on flow of energy and substances between organism and environment in both directions.

Appears at all levels of system (cell – whole organism).





Deviation from desired value **oscillates** or continuously **increases**.

