

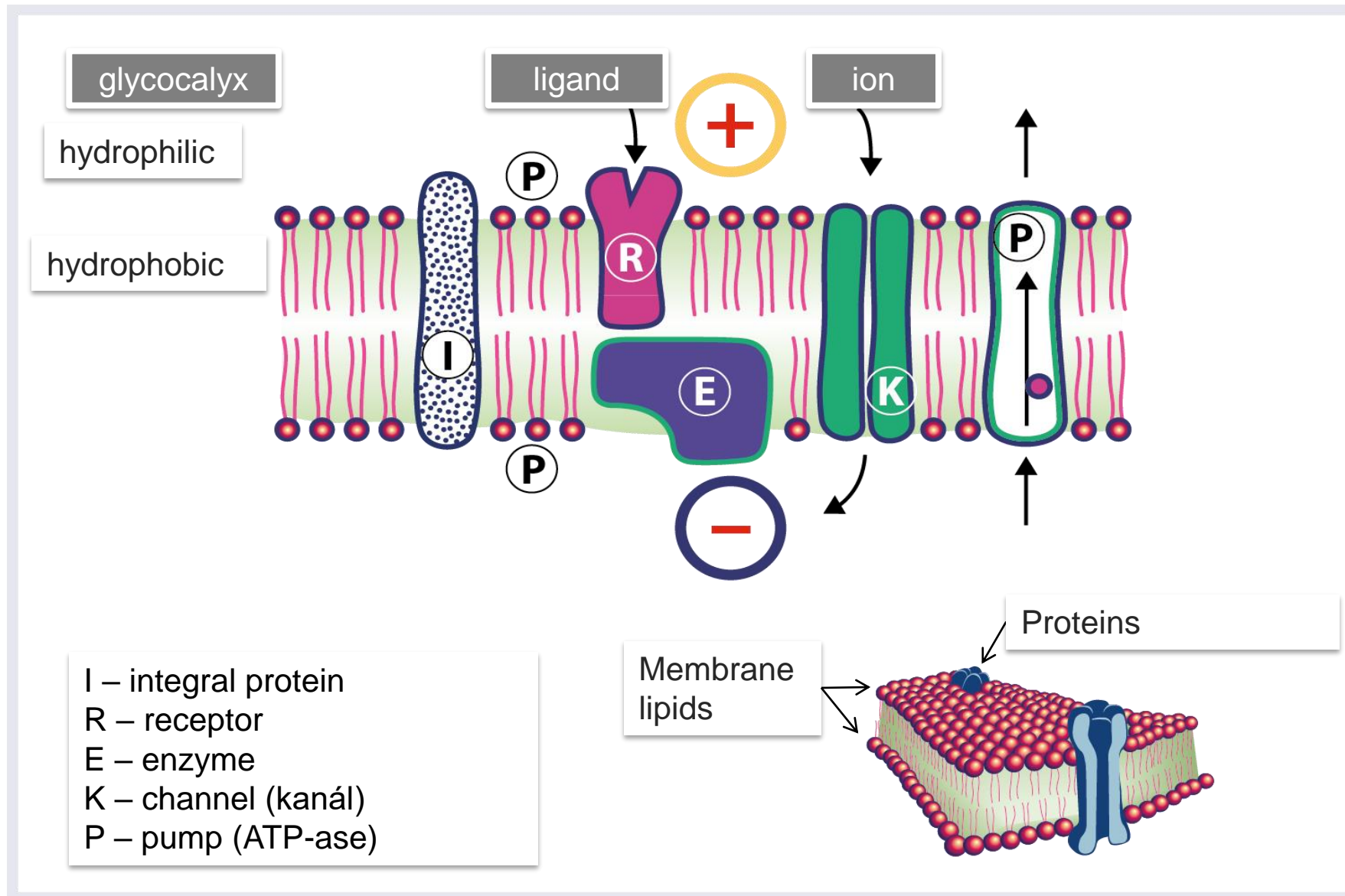
**M U N I  
M E D**

**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> <b>Extracellular fluid (incl. plasma)</b>

Intracellular fluid    40% - 28 litres

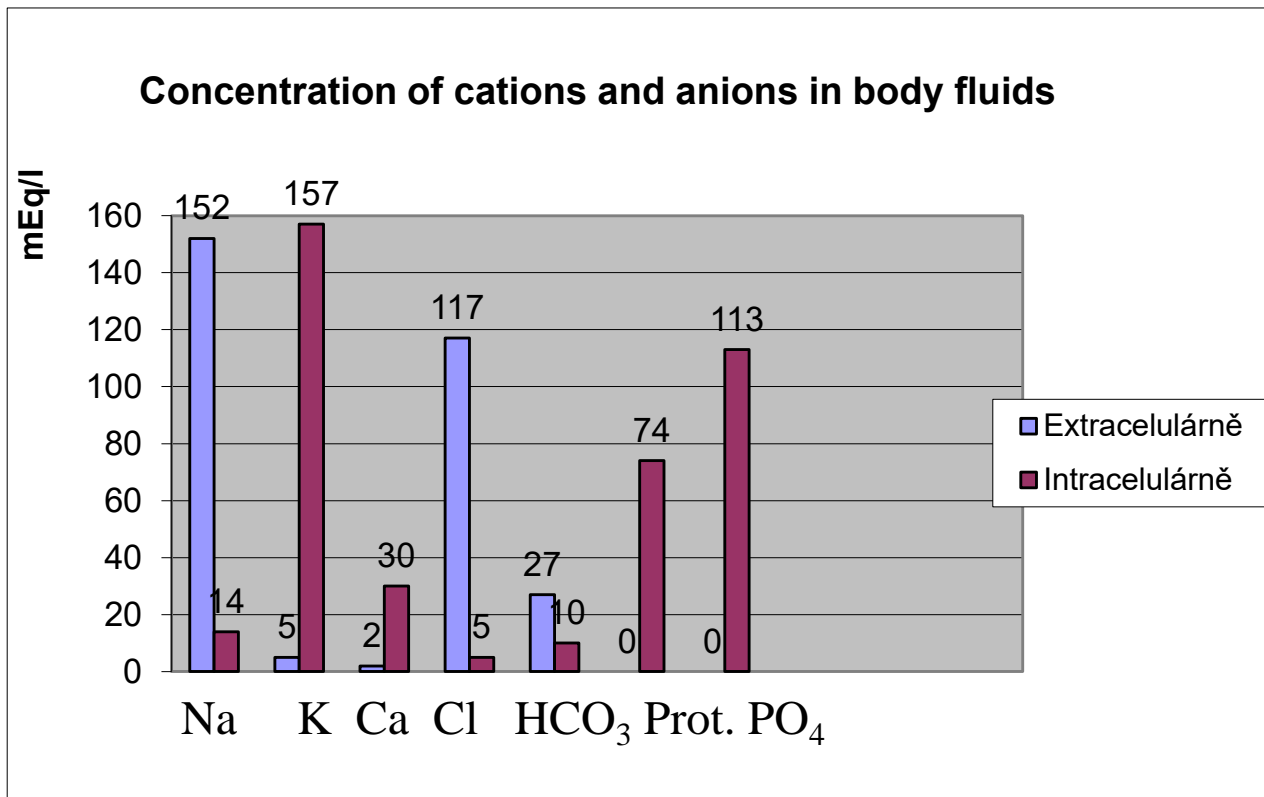
*Antipyrin, D<sub>2</sub>O*

**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**

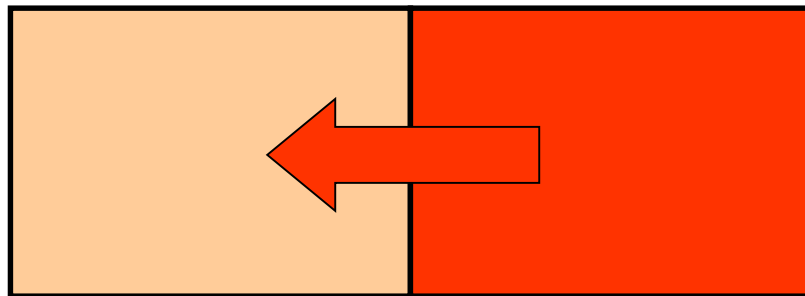
**ANTIPOINT**

## PASSIVE TRANSPORT MECHANISMS

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

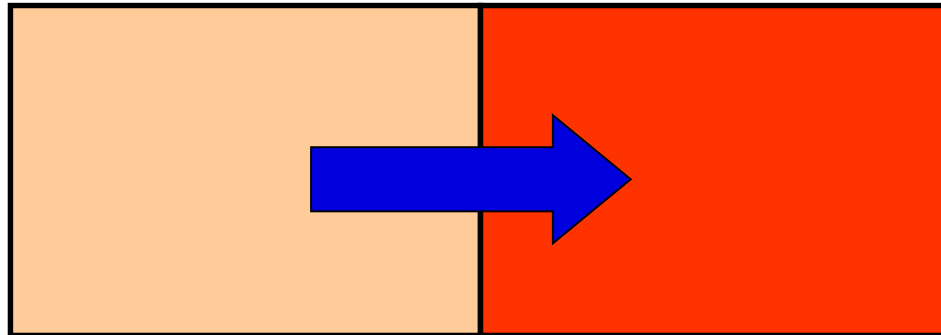
### DIFUSION

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 substance (e.g. in direction to lower concentration of water). It depends on number of particles.

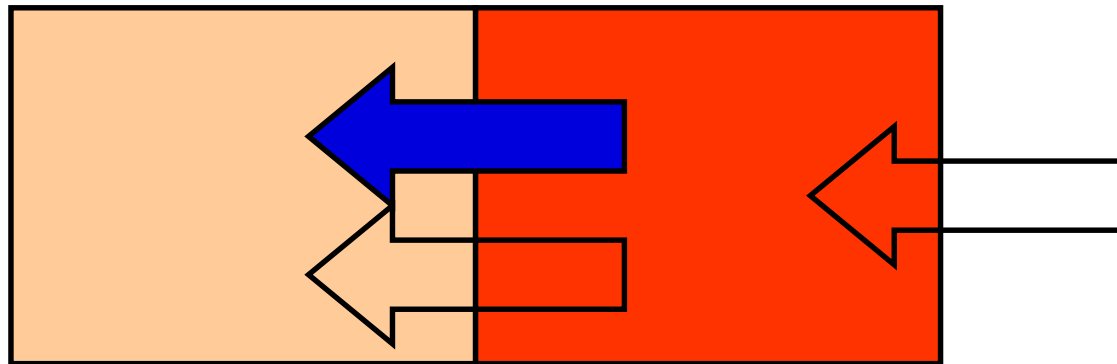




# FILTRATION

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

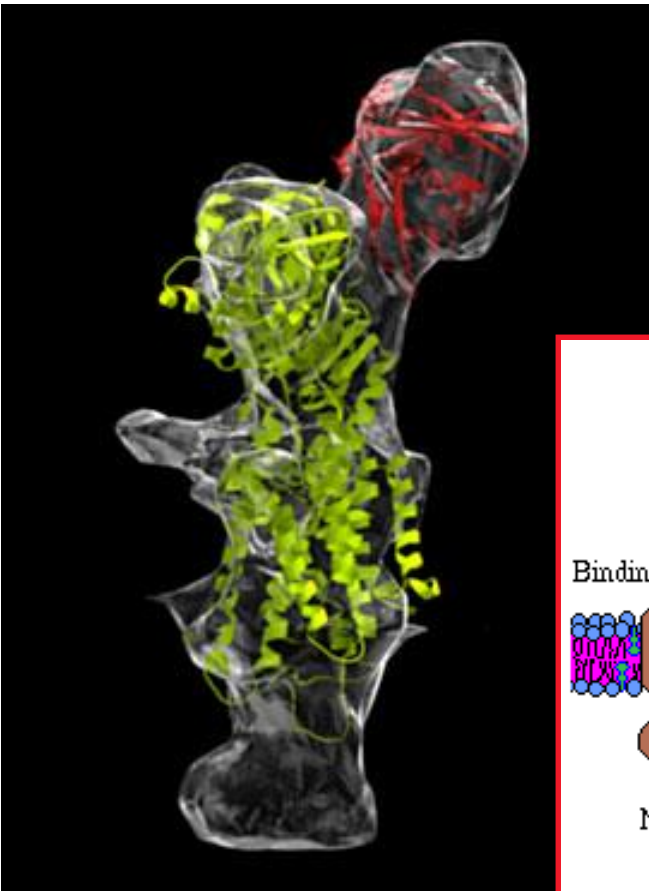
transported compound uses concentration  
gradient of  $\text{Na}^+$  as the driving force

**SYMPORT** in the same direction

**ANTIPOINT** in opposite direction

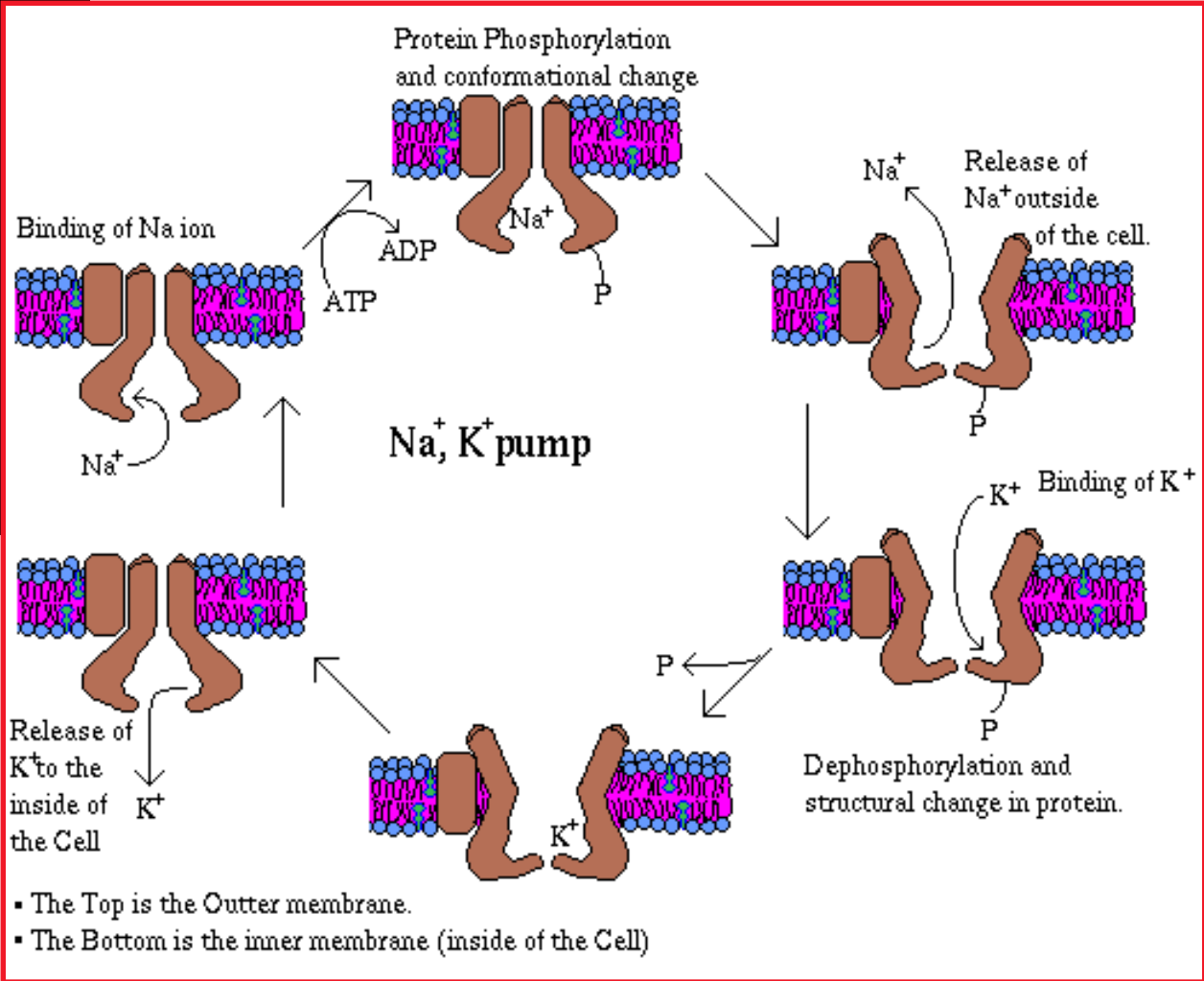
glucose, AA

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



# ACTIVE TRANSPORTS

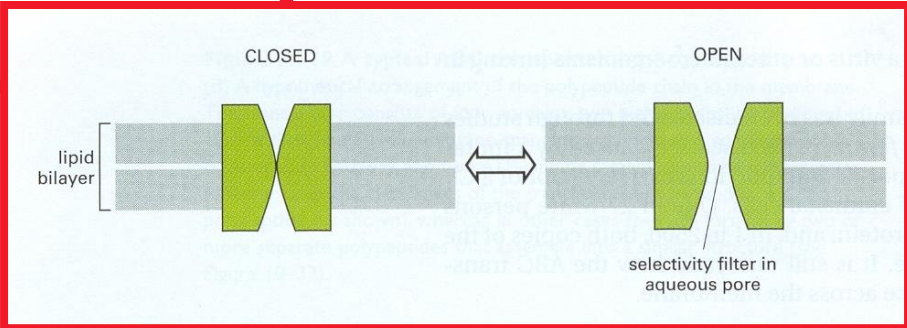
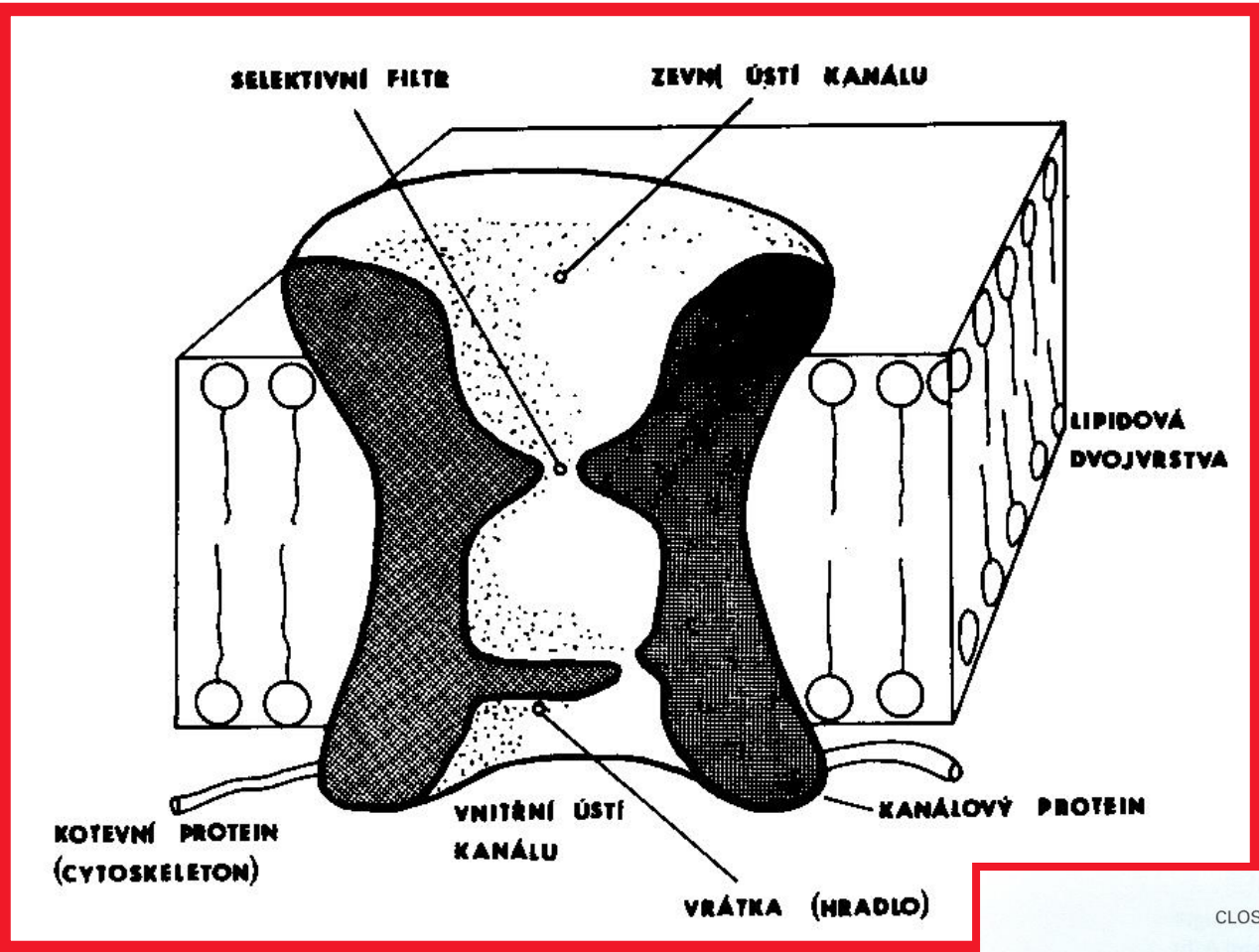
$\text{Na}^+/\text{K}^+$  ATP-ase (exchanger)  
**AGAINST** concentration gradient



Similar transports:

- $\text{Ca}^{2+}/\text{H}^+$
- $\text{Na}^+/\text{K}^+$
- $\text{K}^+/\text{H}^+$
- $\text{Na}^+/\text{H}^+$

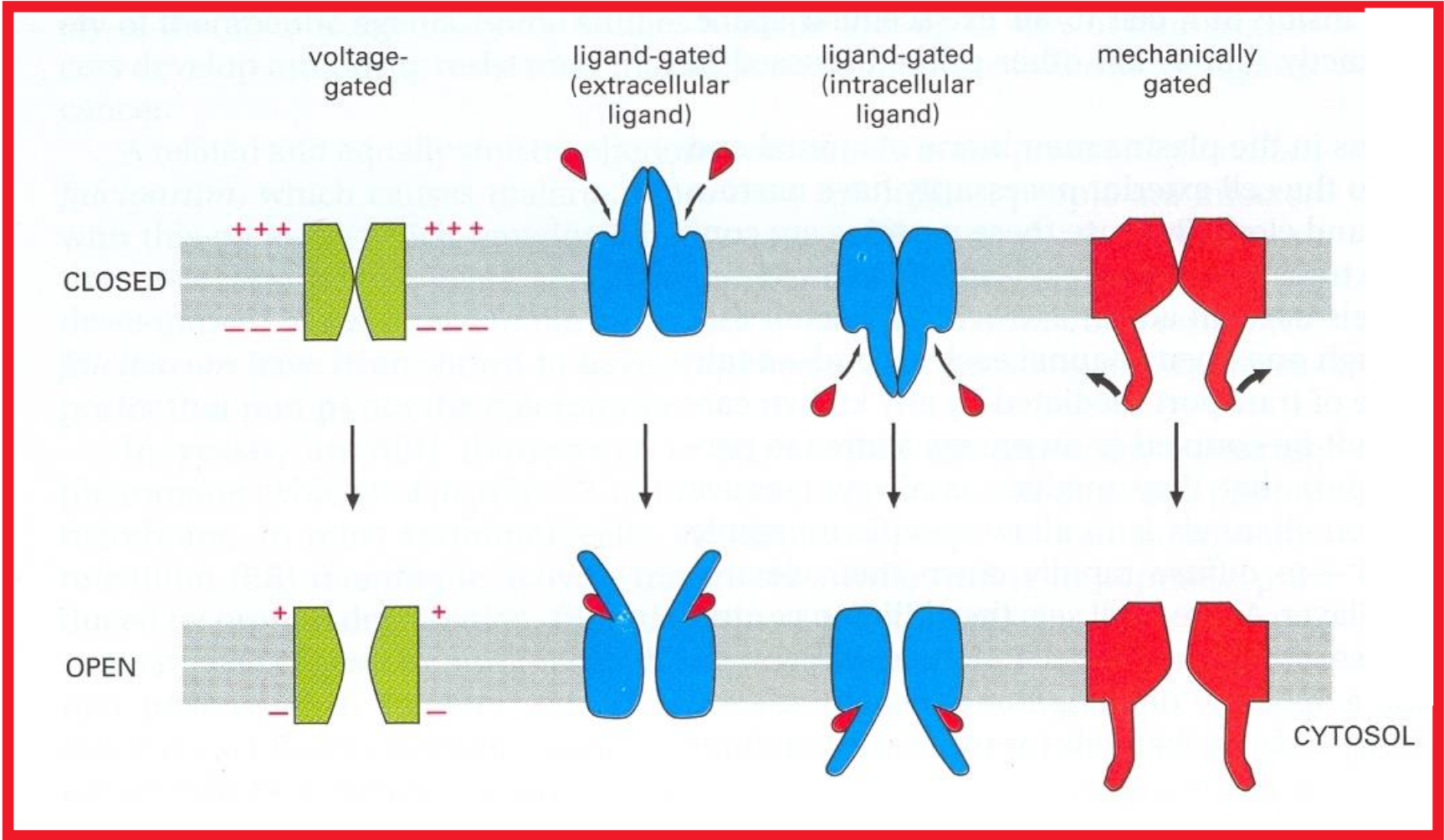
# IONIC CHANNEL



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

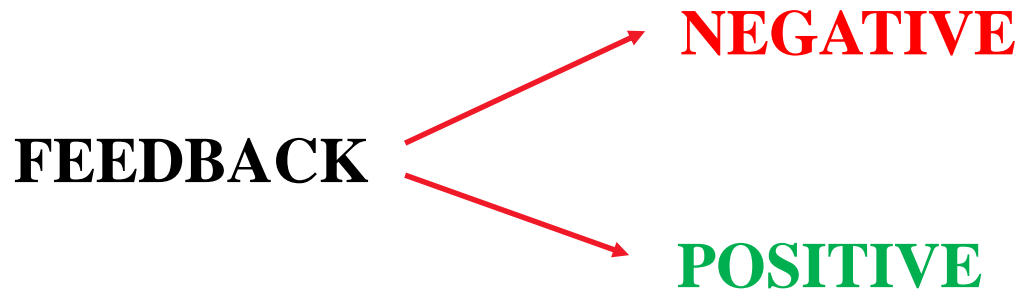
# REGULATION

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**.

