

Action Potential and Ion Channels

Lecture 8

Assoc. Prof. Erkan Tuncay
Department of Biophysics

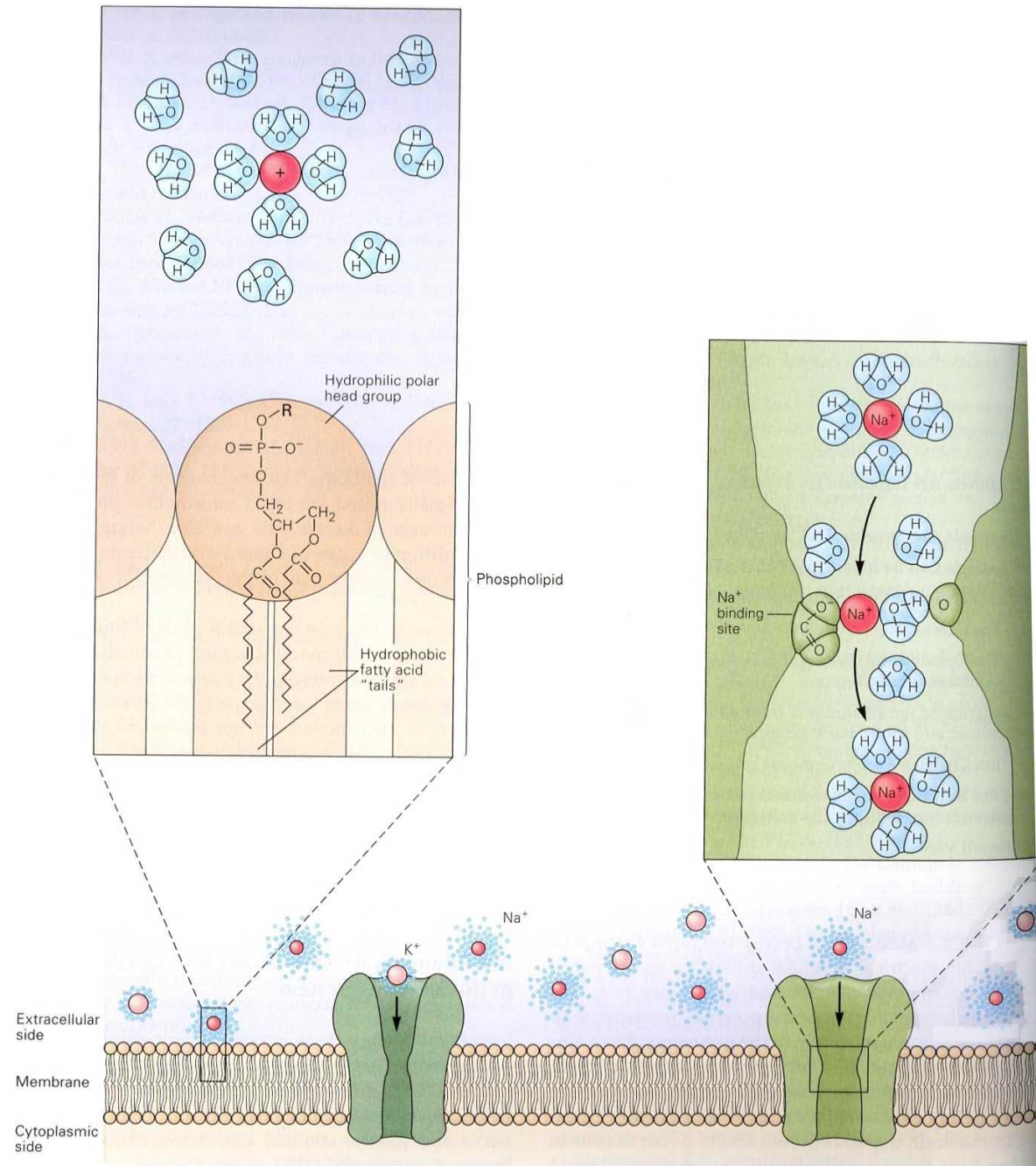
Ion channels

- The rate and direction of ion movement is governed by the electrochemical gradient.
- The rate of ion transport through the channel is very high 10^7 ions/sec. Transport is always down the gradient

• Ion-channels:

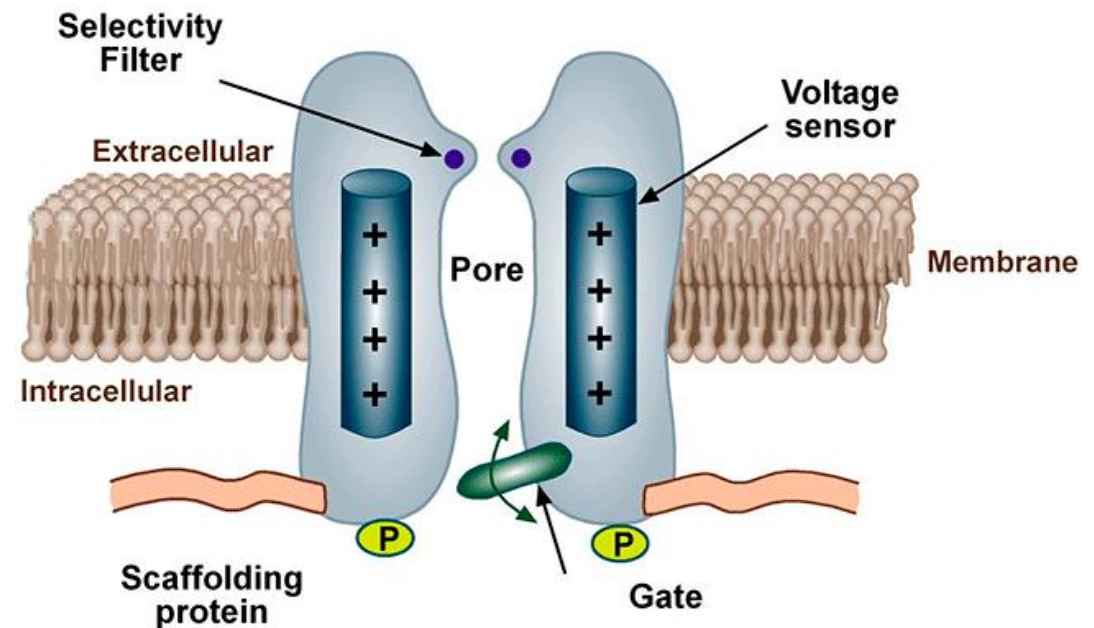
- membrane-bound proteins
- conduct ions across the membrane
- are selective for certain ions
- they open/close in response to a wide range of stimuli:

- a) electrical
- b) mechanical
- c) chemical
- d) thermal
- e) optical
- f) intracellular



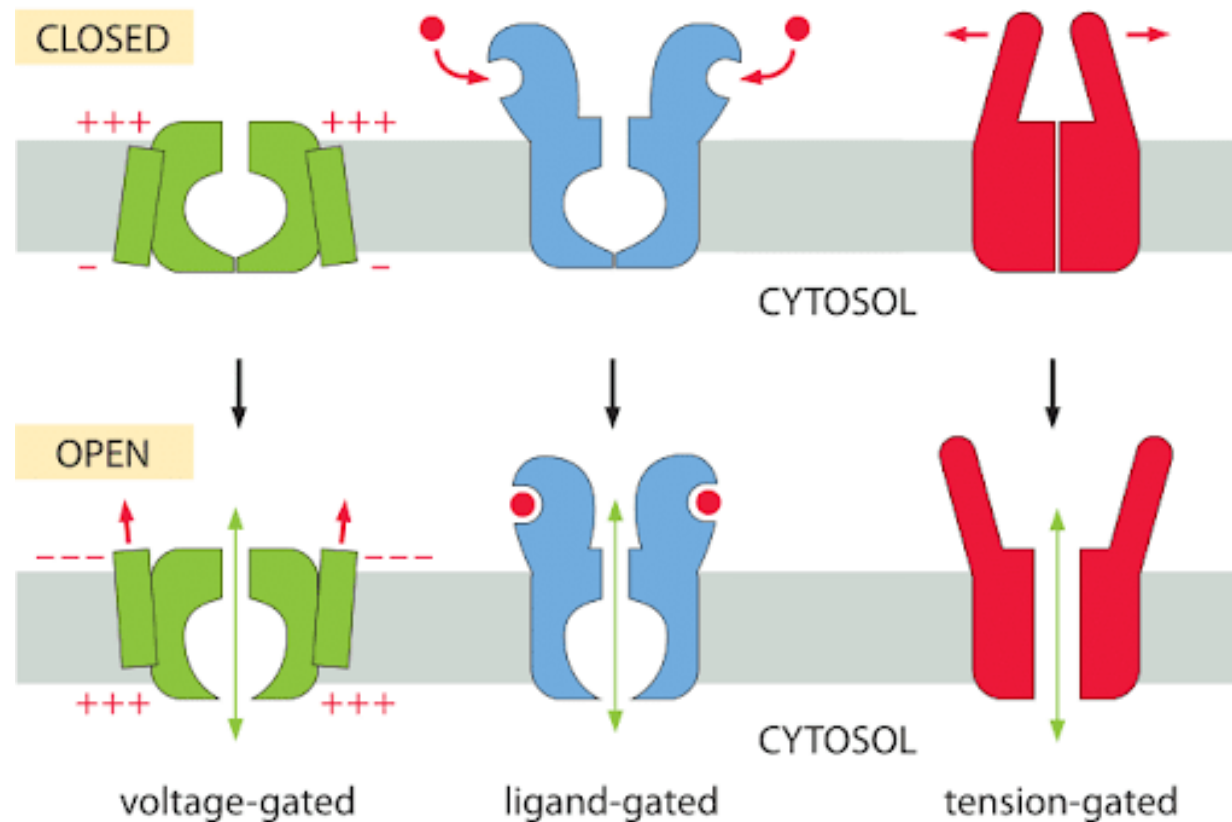
Selectivity:

- Permit ions of a specific size and charge.
- The permeating ions will lose their dissociated water molecules and pass through the hole in the channel which is known as **SELECTIVITY FILTER**.
- This limits their rate of passage.



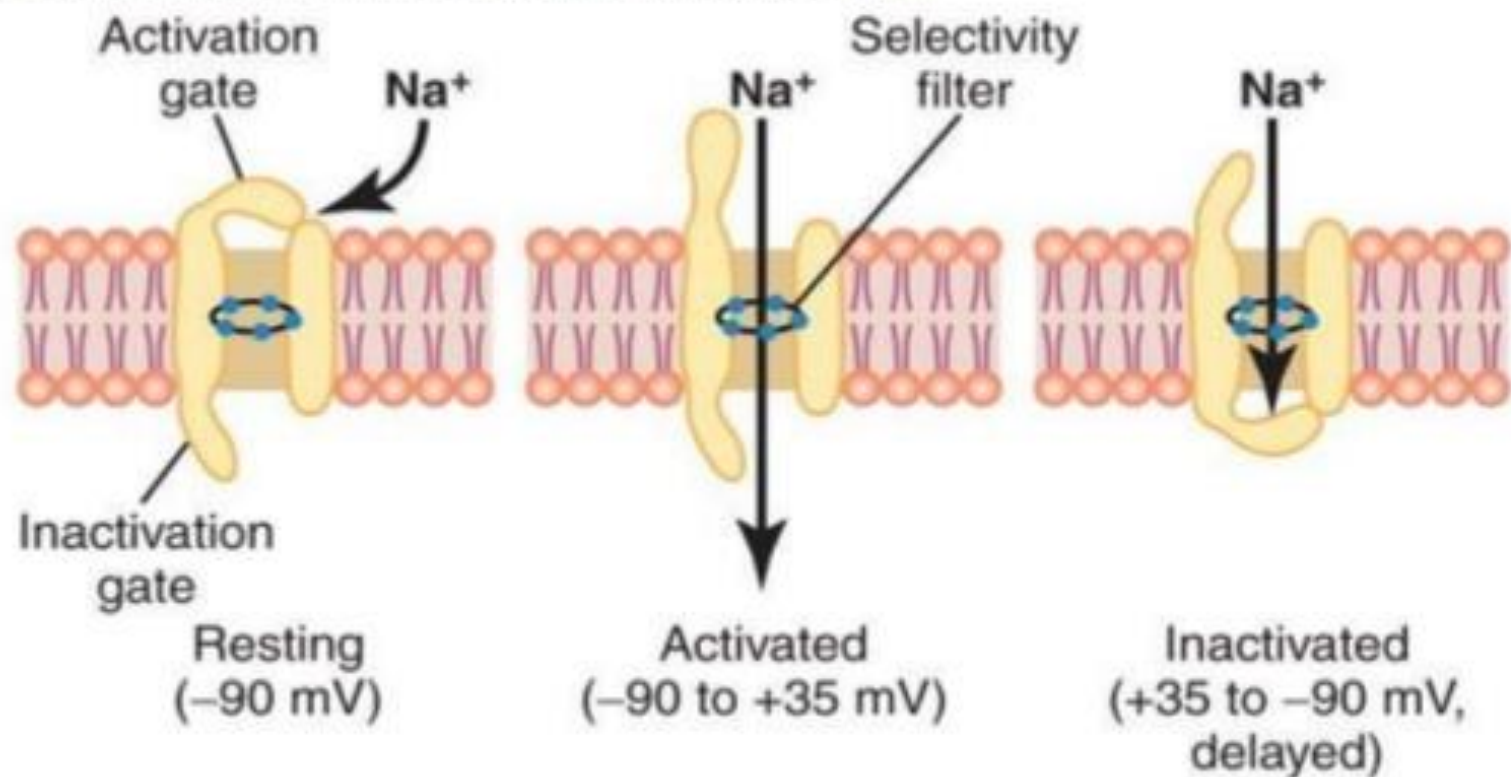
Gating:

- Two discrete states –
 - open(conducting) or closed(nonconducting)



STATES OF ION CHANNEL- CLOSED, OPEN, INACTIVATED

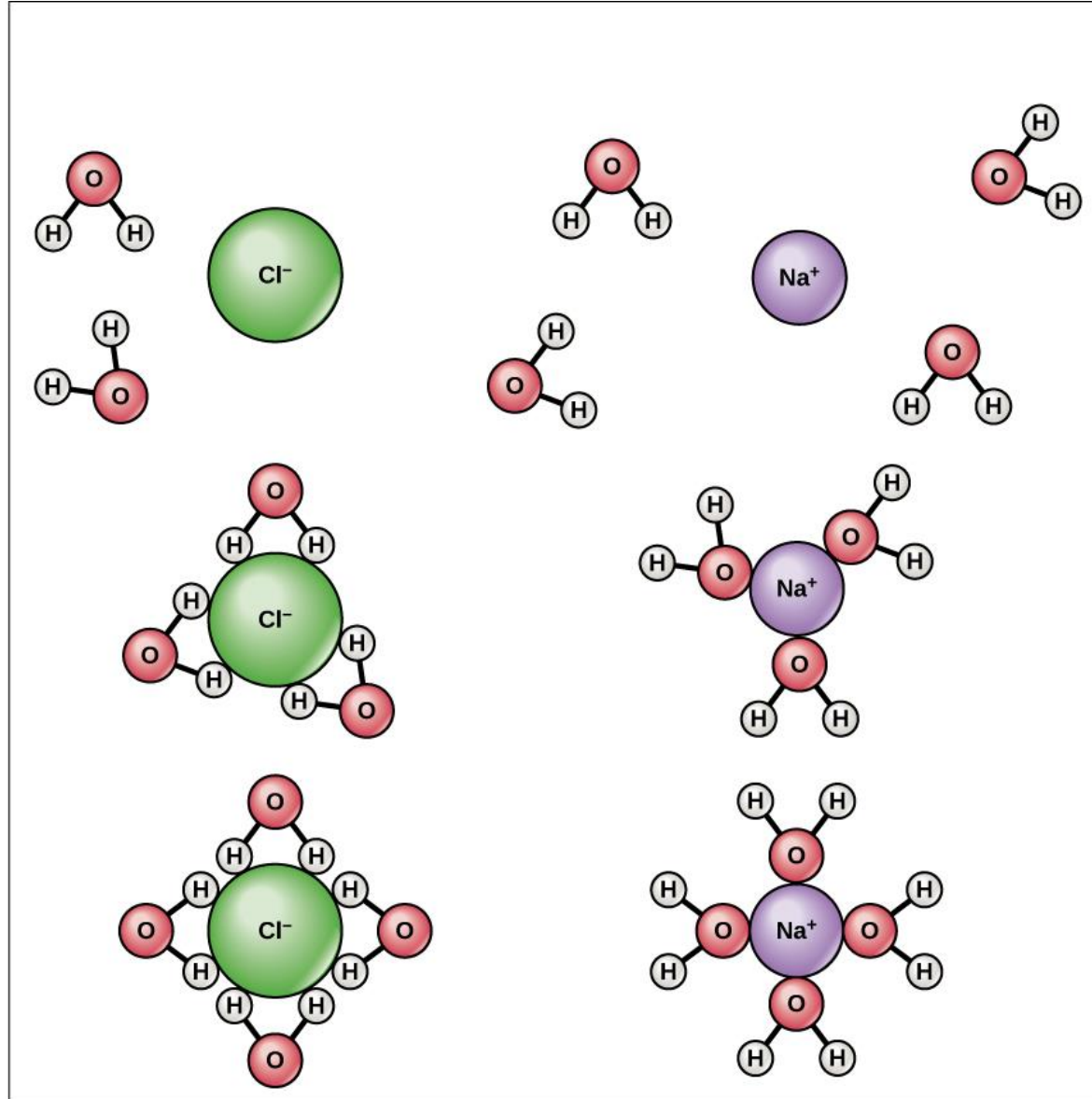
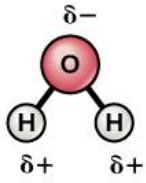
Voltage-Gated Sodium Channel Activation and Inactivation of the Channel



Type of Ligand gated channels:

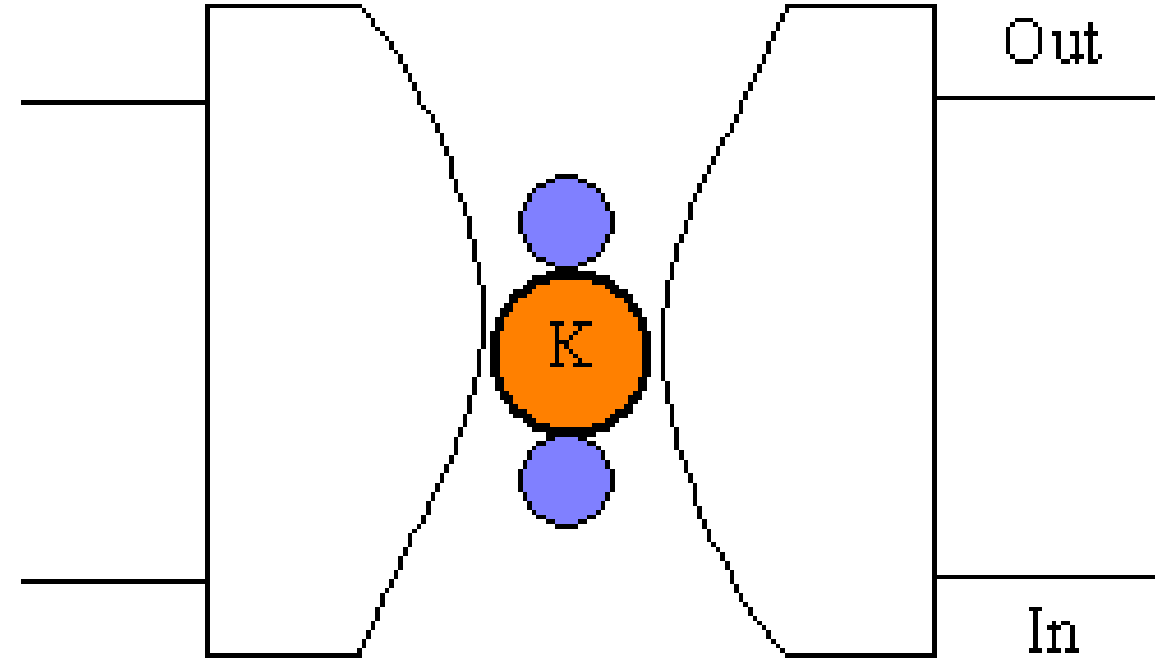
- 1. Extracellularly activated ligand-gated ion channel :
 - The receptors of the cys-loop family (nicotinic receptors, 5-HT₃, GABA_A and GABA_C, glycine and serotonin)
 - The glutamate activated cationic channels (NMDA, AMPA, kainate receptors)
- 2. Intracellularly activated ligand-gated ion channel:
 - ATP sensitive potassium pump
 - Calcium activated-potassium pump, chloride pump
 - G-protein activated potassium pump
 - Aquaporin (cGMP gated ion channels)

A single water molecule with partial charges



Ion Selectivity

A



B

