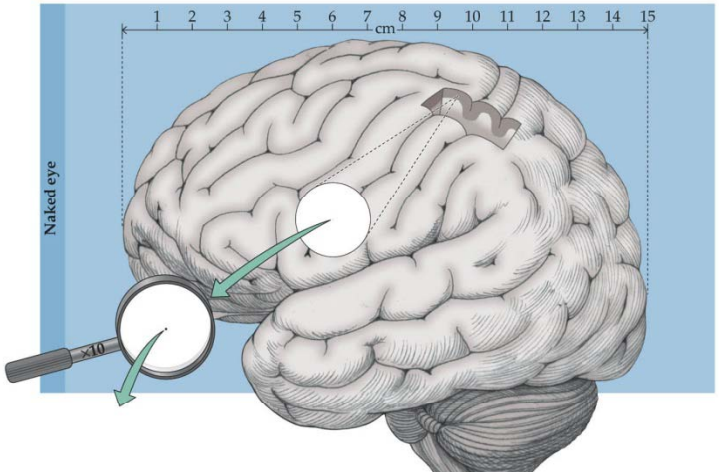
Membrane Potential

Study material for B,SC (H)
Physiology 2nd Sem

»Dr. Atanu Saha

Membrane Potentials

1. Resting Membrane Potential
2. Excitatory Post-synaptic Potential (EPSP)
3. Inhibitory Post-synaptic Potential (IPSP)
4. Action Potential

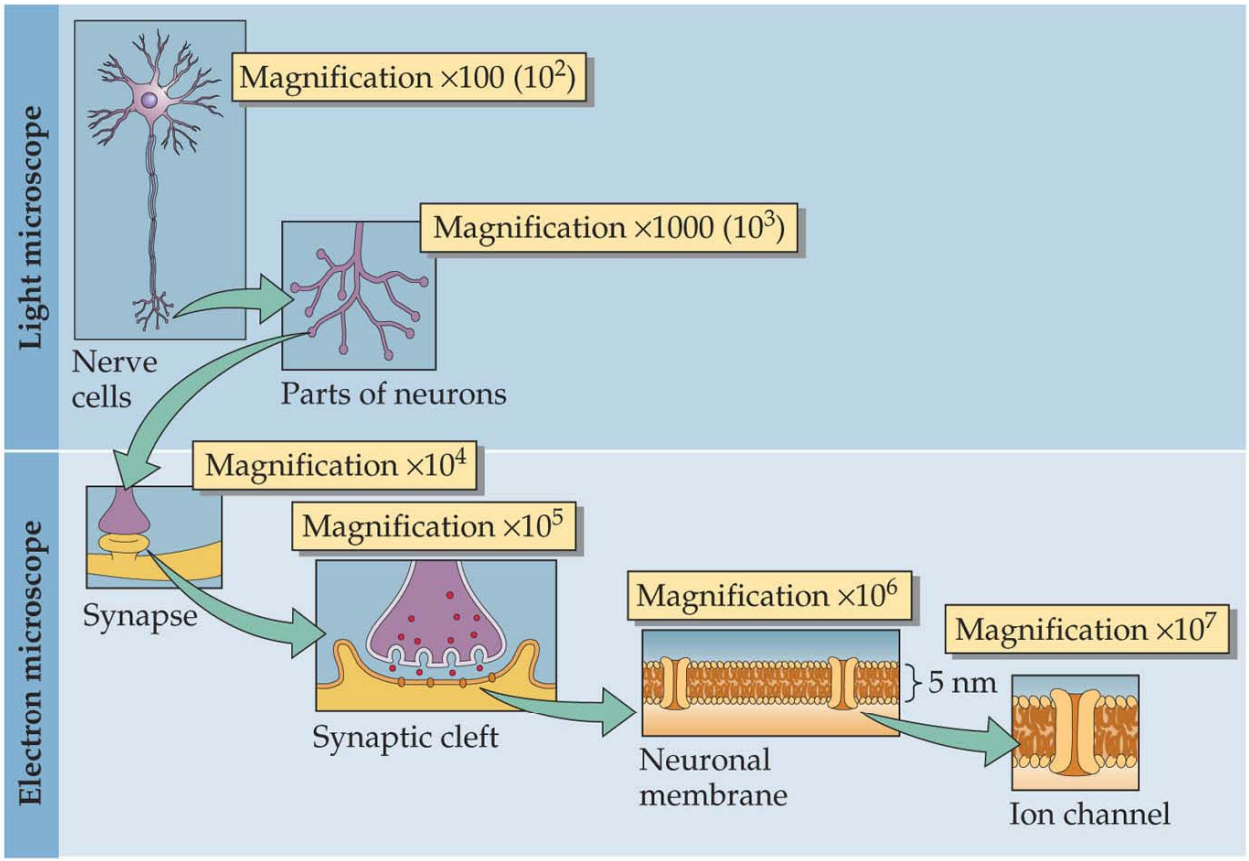


Levels of Investigation

Next weeks

- Organism
- Systems

(e.g. Vision)



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Today

- **Cell**
- **Synapsis**

Next weeks

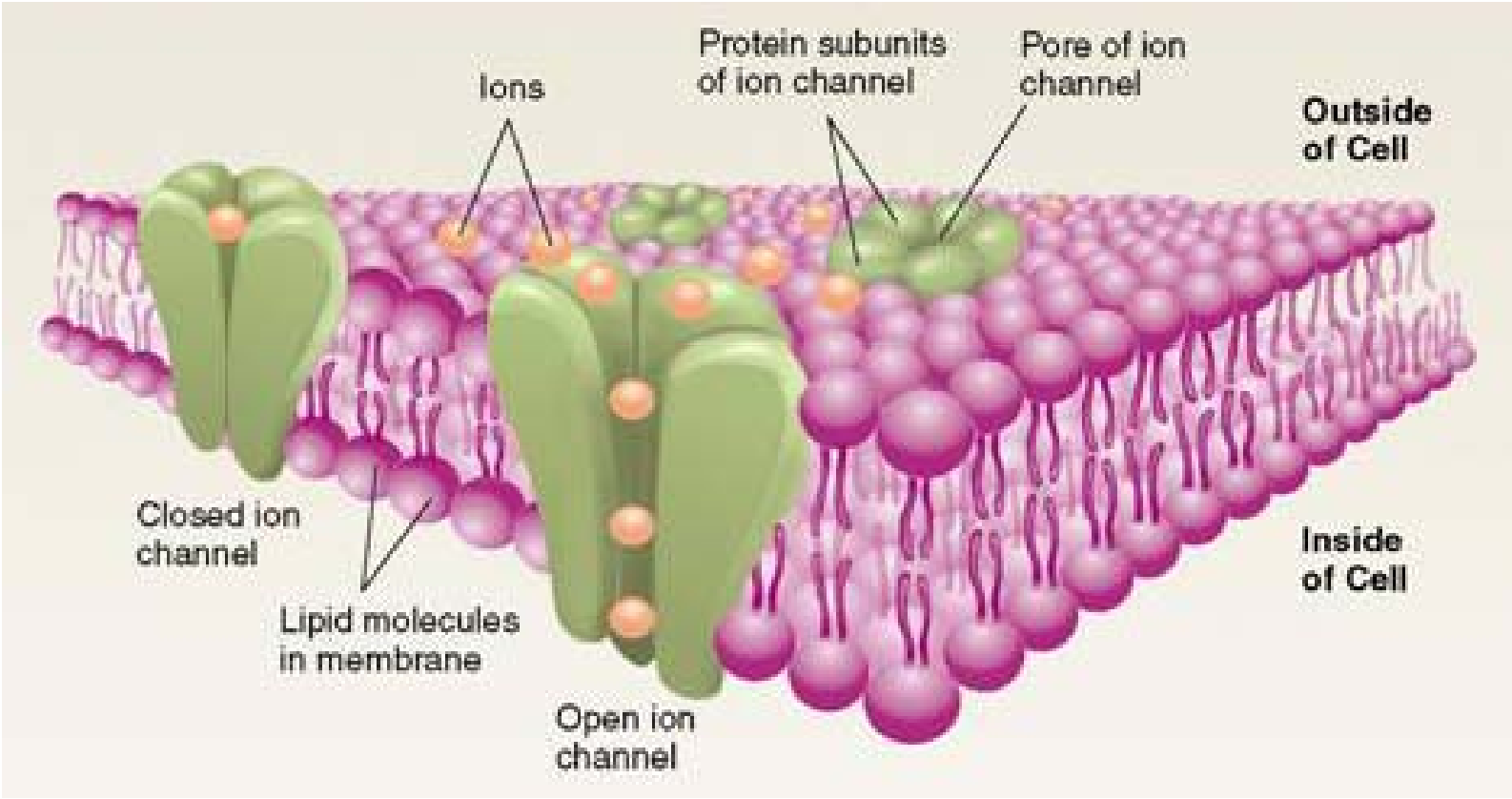
- Molecule

1. Resting Membrane Potential

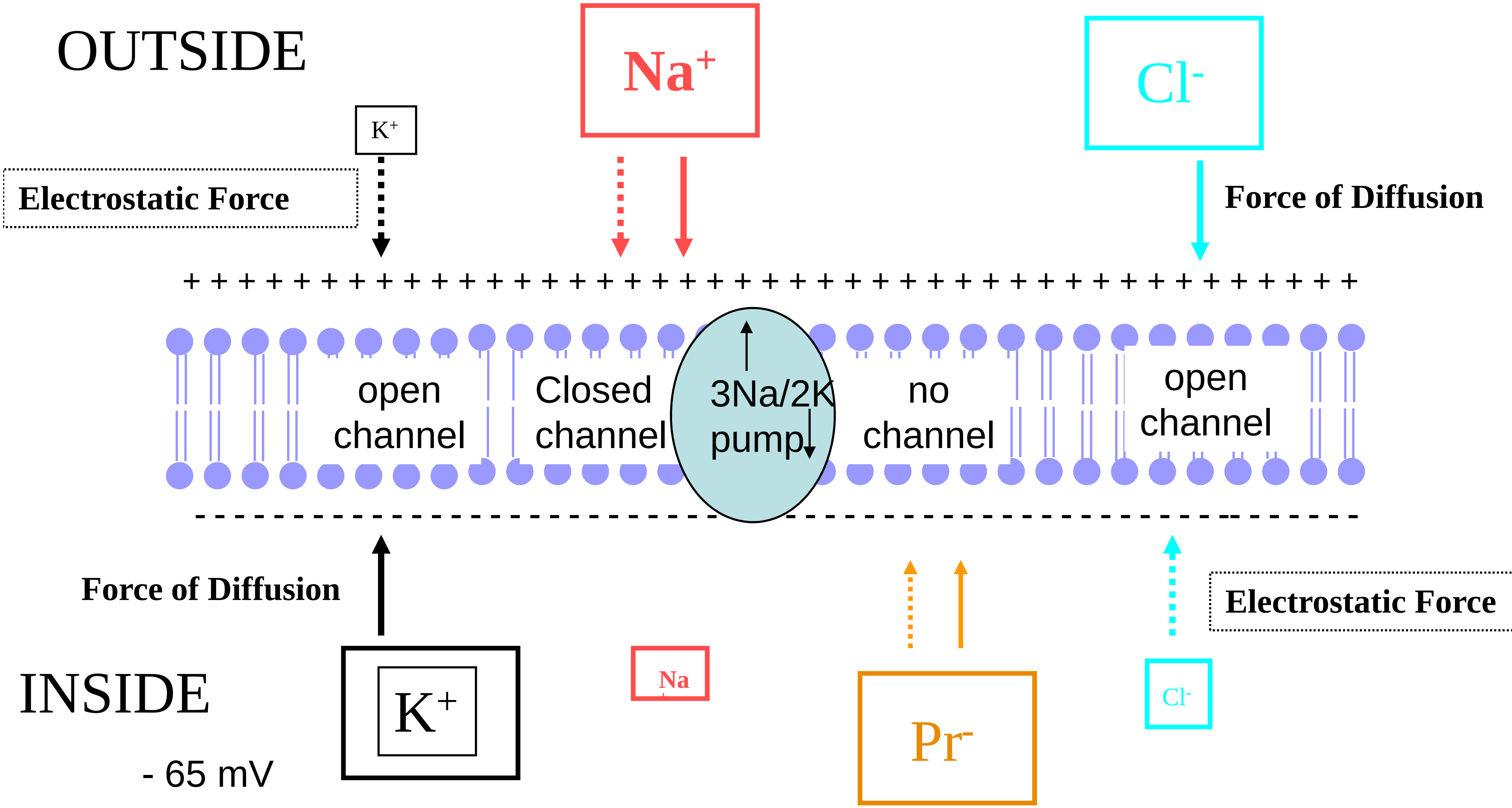
Click on animation website or main website (here)

- Neurons have a selectively permeable membrane
- During resting conditions membrane is:
  - permeable to potassium (K^+) (channels are open)
  - **im**permeable to sodium (Na^+) (channels are closed)
- Diffusion force pushes K^+ out (concentration gradient)
- This creates a positively charged extra-cellular space.
- Electrostatic force pushes K^+ in
- Thus, there is a 'dynamic equilibrium' with zero net movement of ions.
- The resting membrane potential is negative (- 60mv)

Cell Membrane



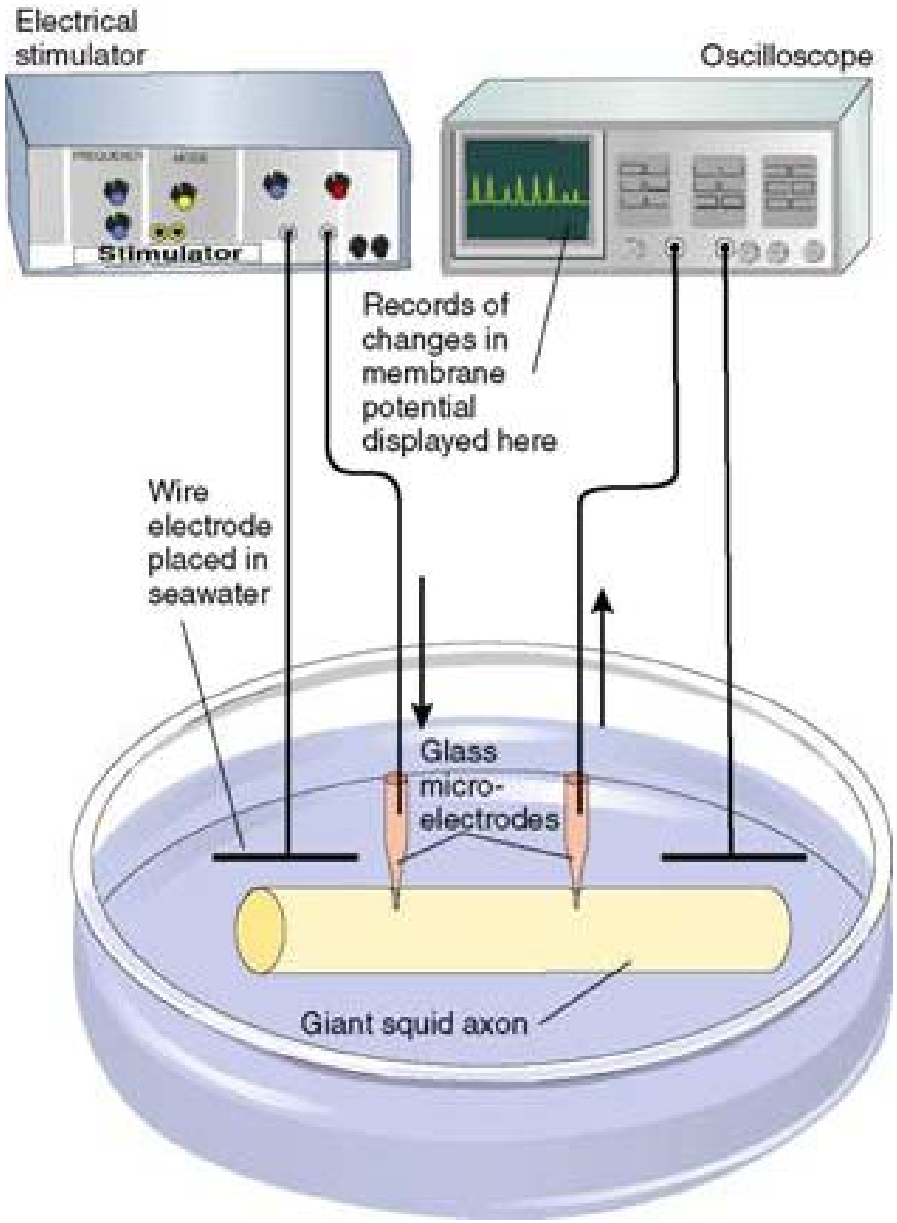
Resting Membrane Potential



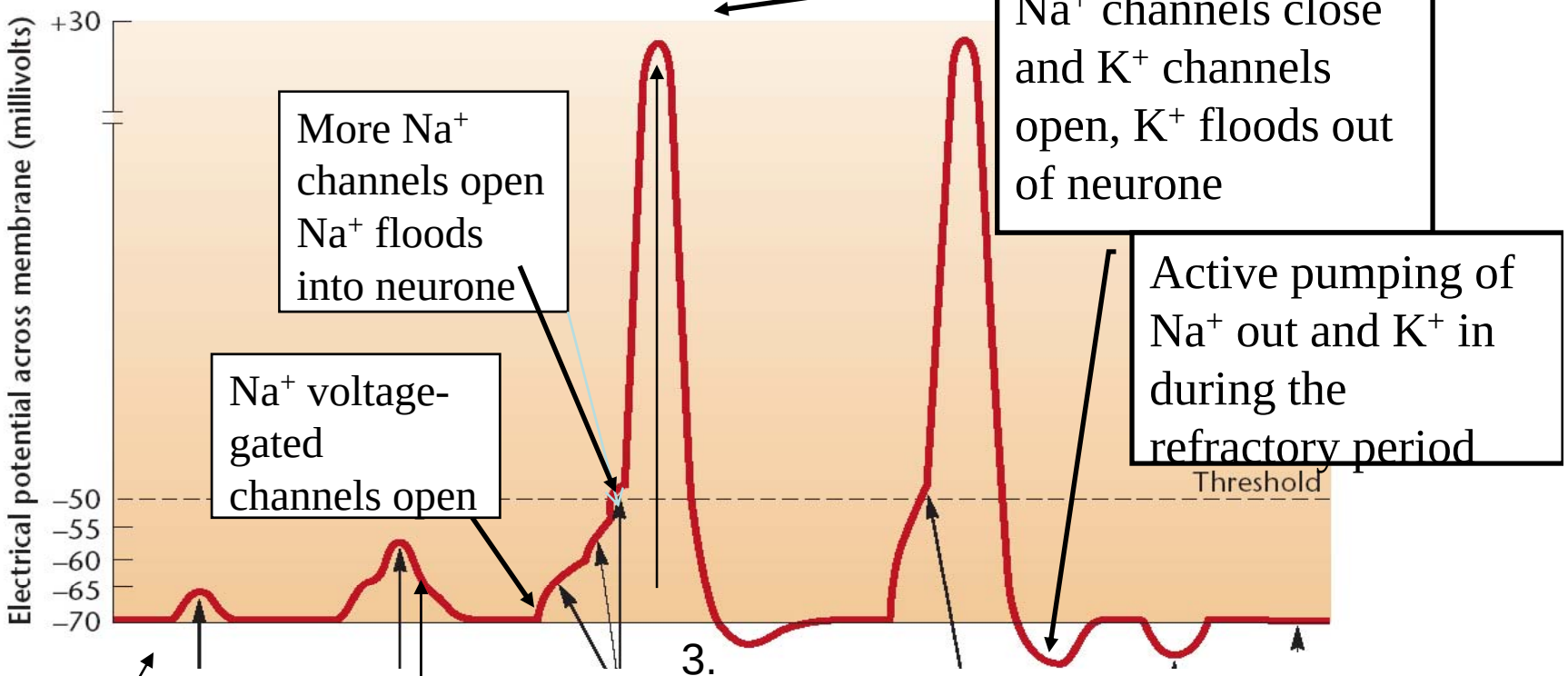
K^+ = Potassium; Na^+ = Sodium; Cl^- = Chloride; Pr^- = proteins

Resting membrane potential:
(things you need to know)

a. Concept of ‘Selective membrane’
b. How permeable the membrane is to proteins, K+, and Na+
c. Diffusion and electrostatic forces and how they act on K+ and Na+
d. Concept of ‘Dynamic equilibrium’
e. Concept of ‘Membrane potential’
f. ATP Na/K pump and its role in maintaining the membrane potential



Membrane Potentials



1. Resting Potential (Polarized))

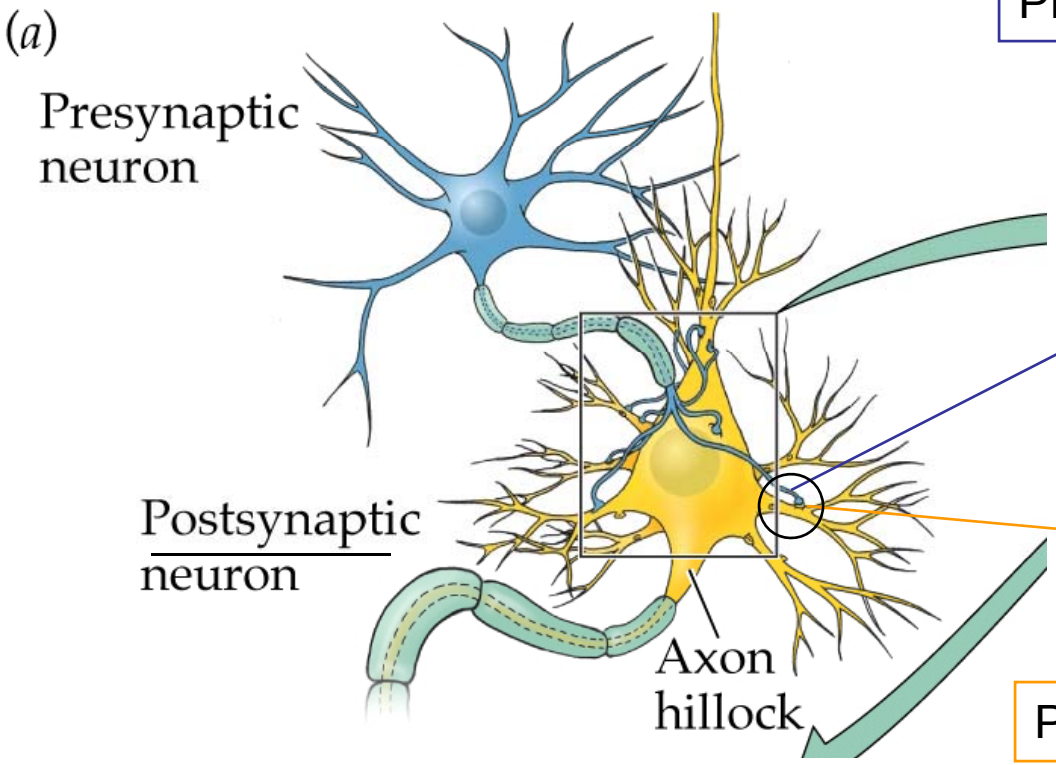
2. **Excitatory** Post-synaptic potential(De polarization)

3. Action Potential

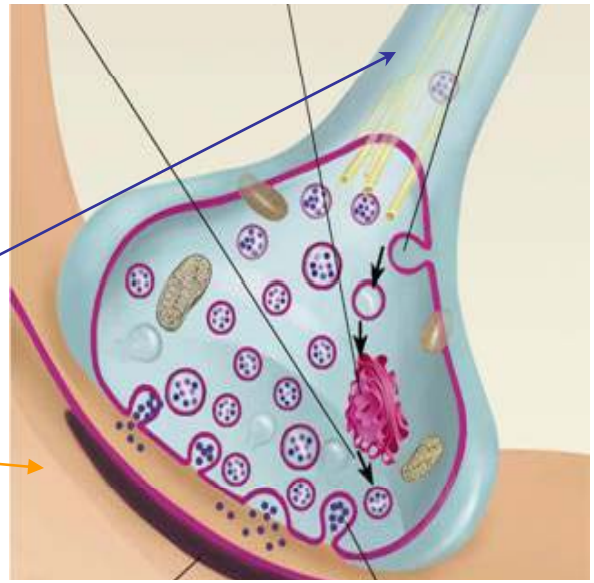
threshold

4. **Inhibitory** Post-synaptic potential(Hype rpolarization)

2. Excitatory Post-synaptic Potential (EPSP)



Pre-synaptic neuron



Post-synaptic neuron

Excitatory Post-synaptic Potential (EPSP)

1. The pre-synaptic neuron releases a neurotransmitter.

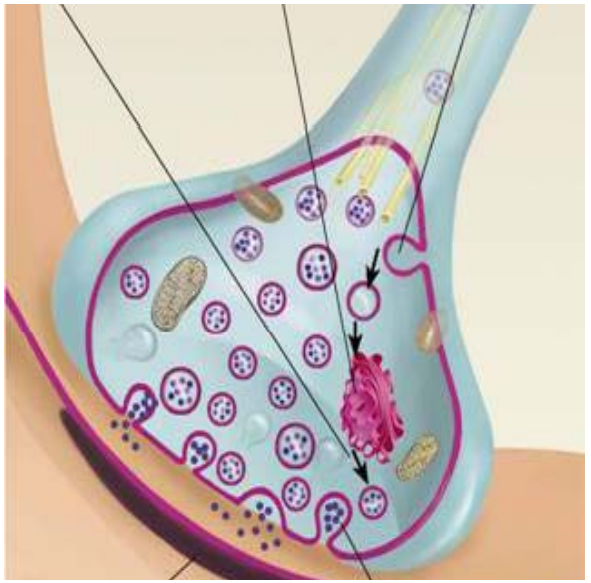
2. Neurotransmitter diffuses across extra-cellular space - synaptic cleft.

3. Neurotransmitter binds to post-synaptic receptor.

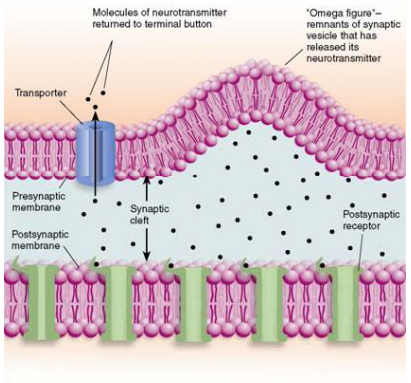
4. Binding of neurotransmitter causes Na+ channels in **post-synaptic** membrane to open.

5. Depolarization occurs (**excitatory potential**)

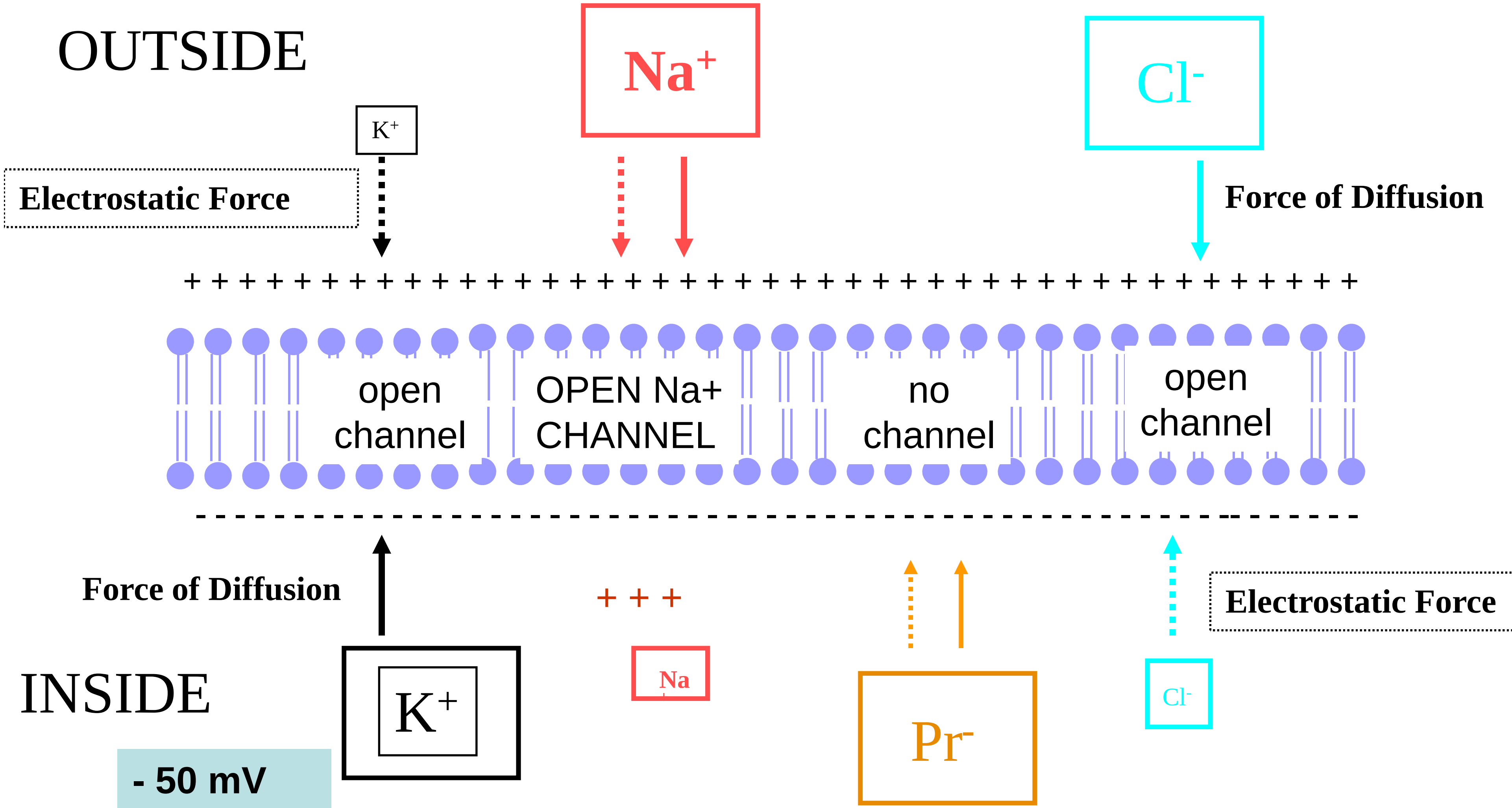
Pre-synaptic neuron



Post-synaptic neuron



Excitatory Post-Synaptic Potential (EPSP)



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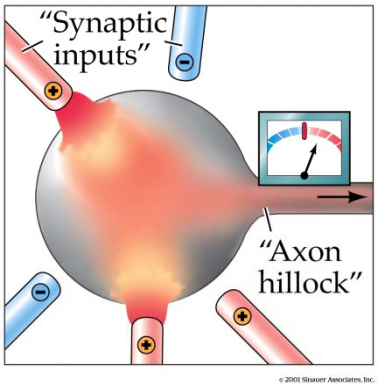
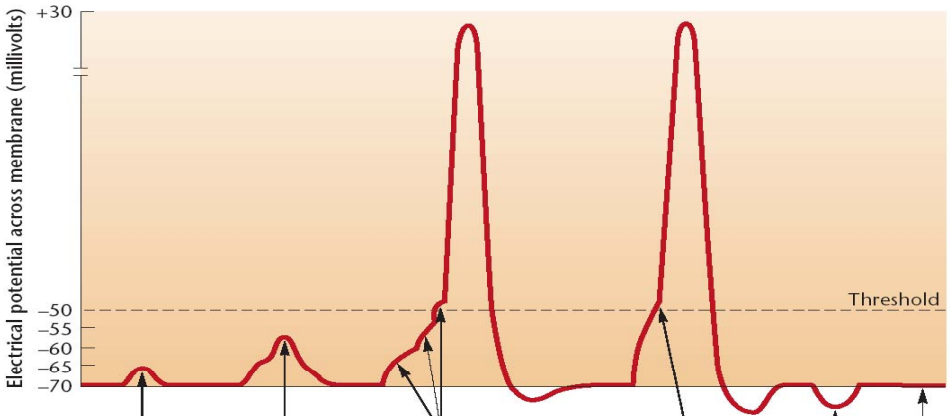
EPSP

- EPSP is a “graded” potential
- Multiple EPSPs are integrated across space and time.



- Once the threshold is reached, voltage-dependent sodium channels are opened



- The cell is depolarized (action potential)

Excitatory Post-synaptic potential

Integration

3. Inbibitory Post-synaptic Potential (IPSP)