# Pre-postsynaptic Signals, Action Potential Properties

# Lecture 9

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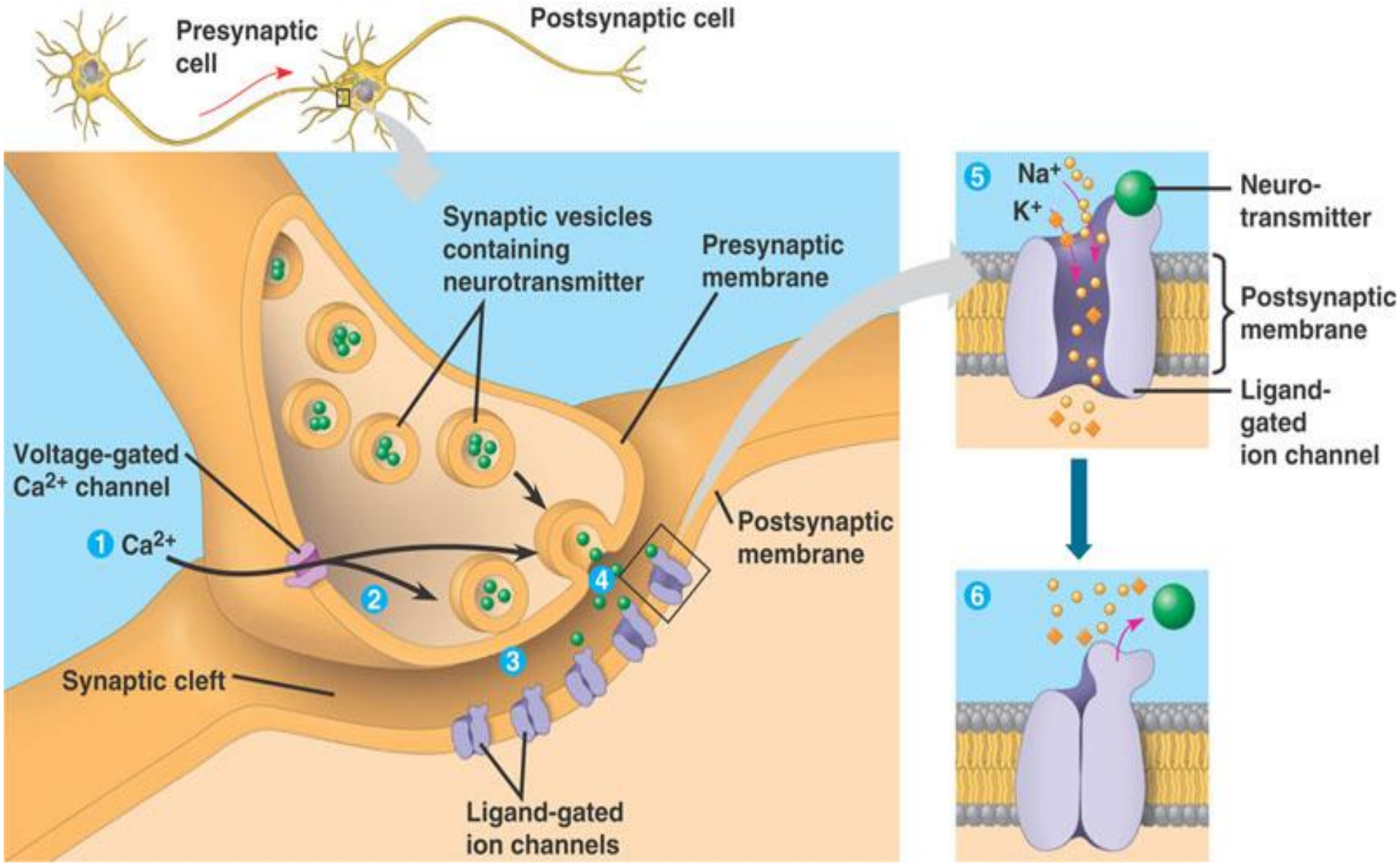
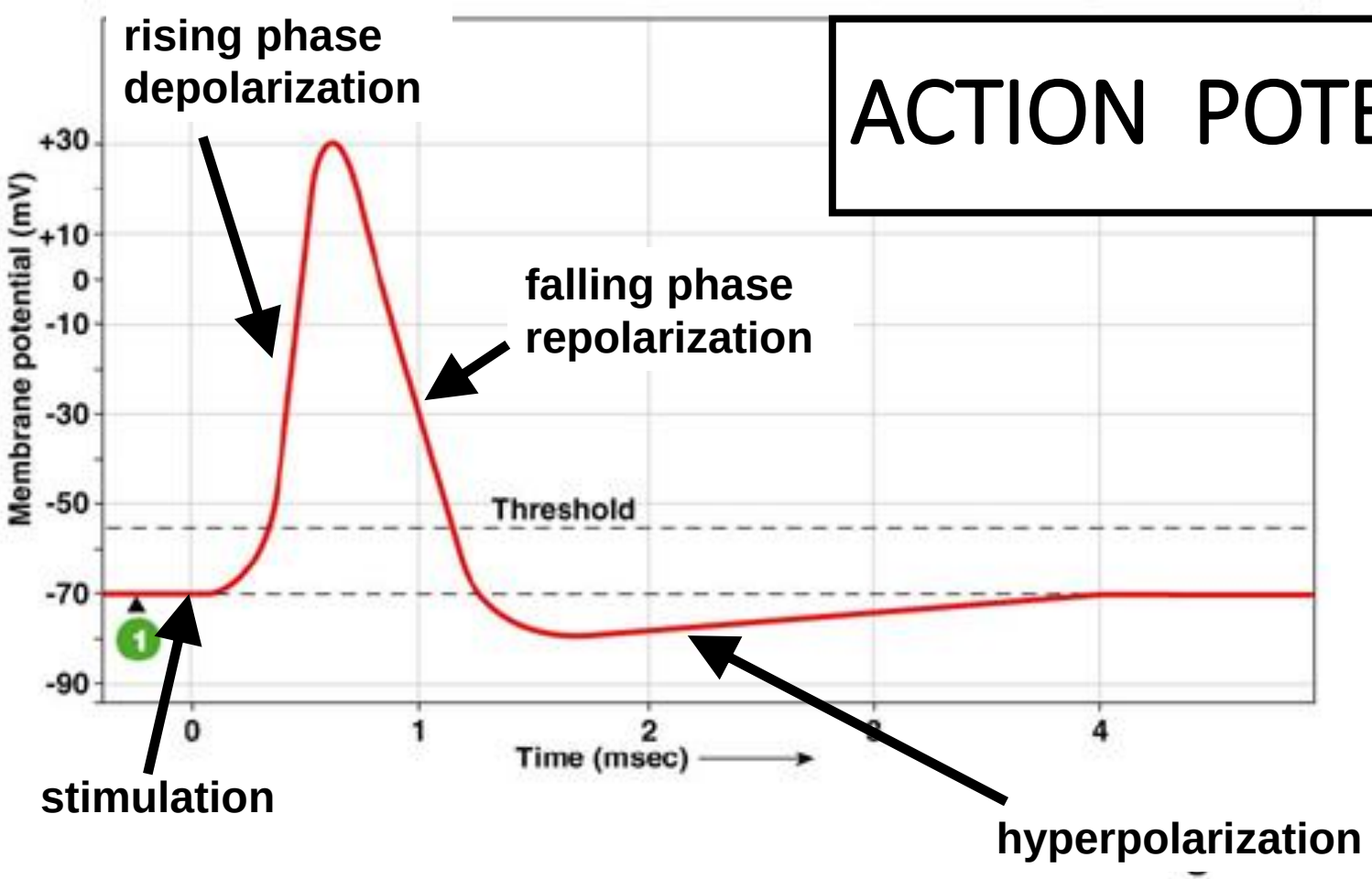
Department of Biophysics

## **Summation of postsynaptic potentials** (stimulation of several synapses with ligand gated ion channels)



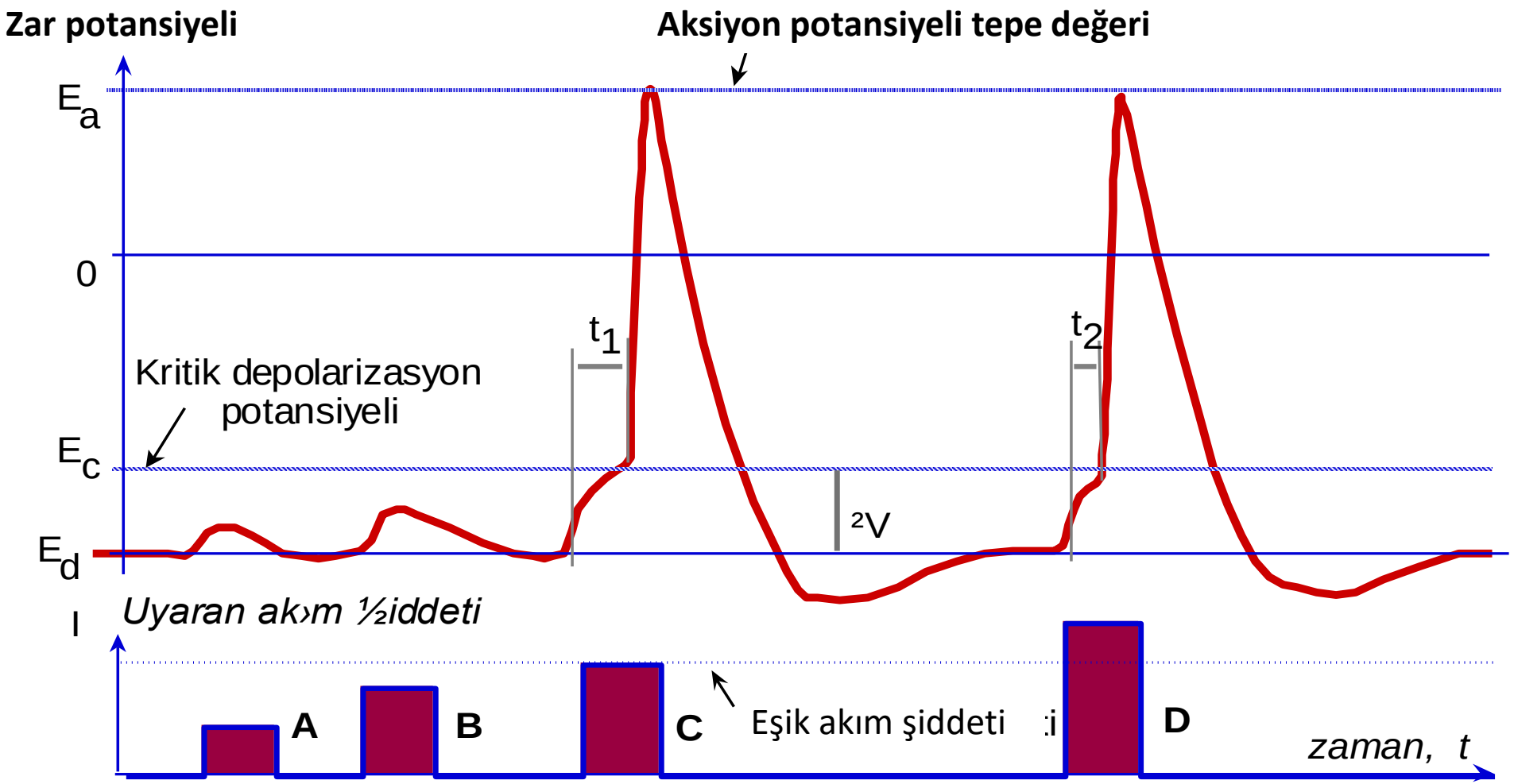
# ACTION POTENTIAL



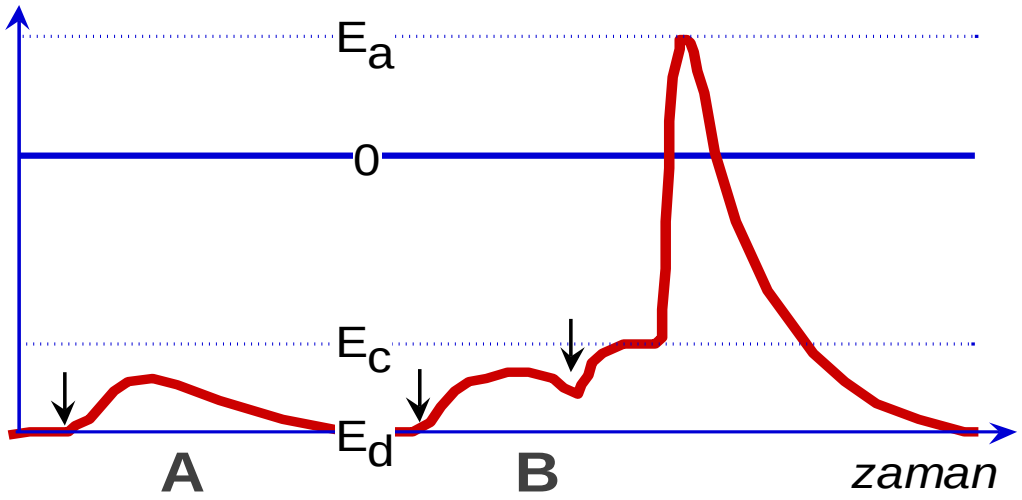

**Action potential (nerve impulse) - at excitable conductive tissues = nerve fibers & muscle cells if depolarization reaches the gate threshold = firing level.**

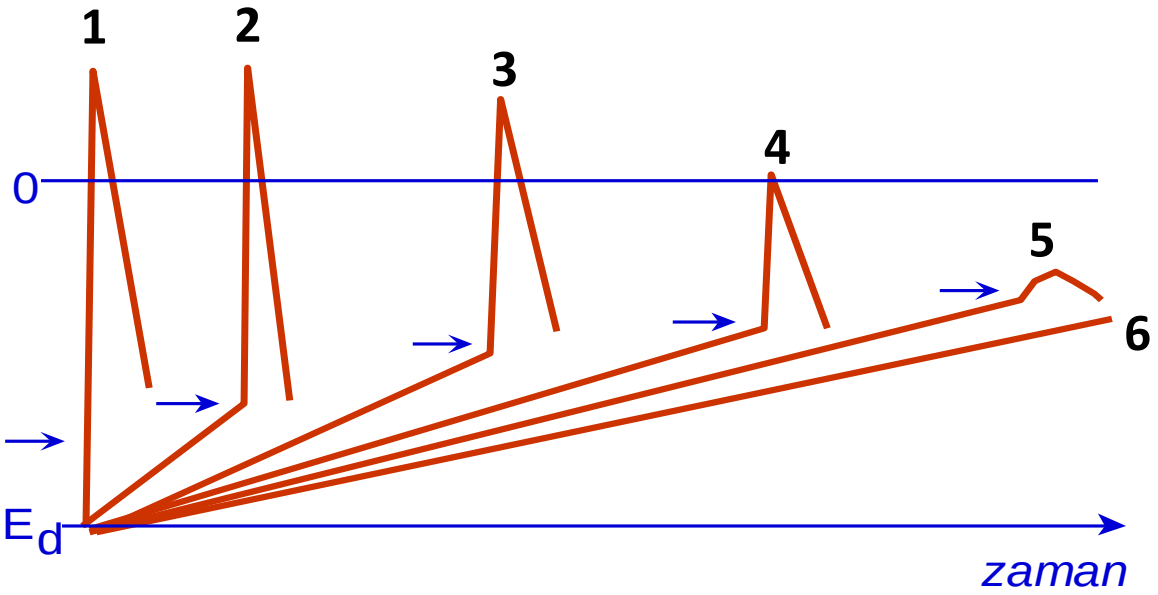
**It is all-or-none (it happens or do not happen).**

# Stimulation of a cell

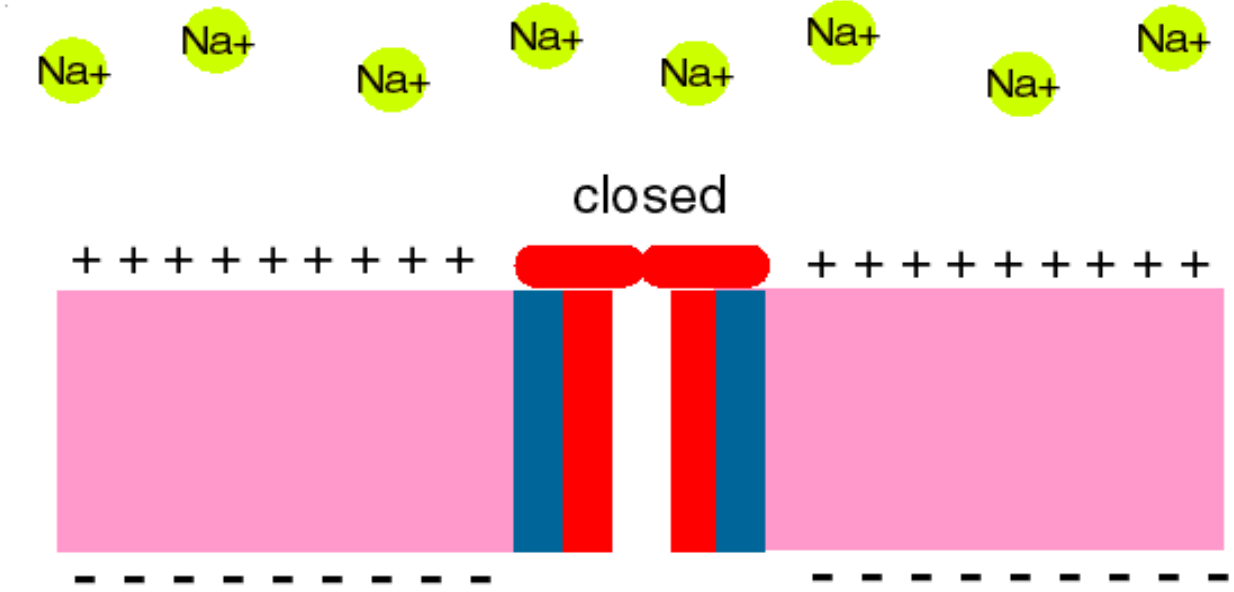


# Stimulation of a cell with under-threshold potentials



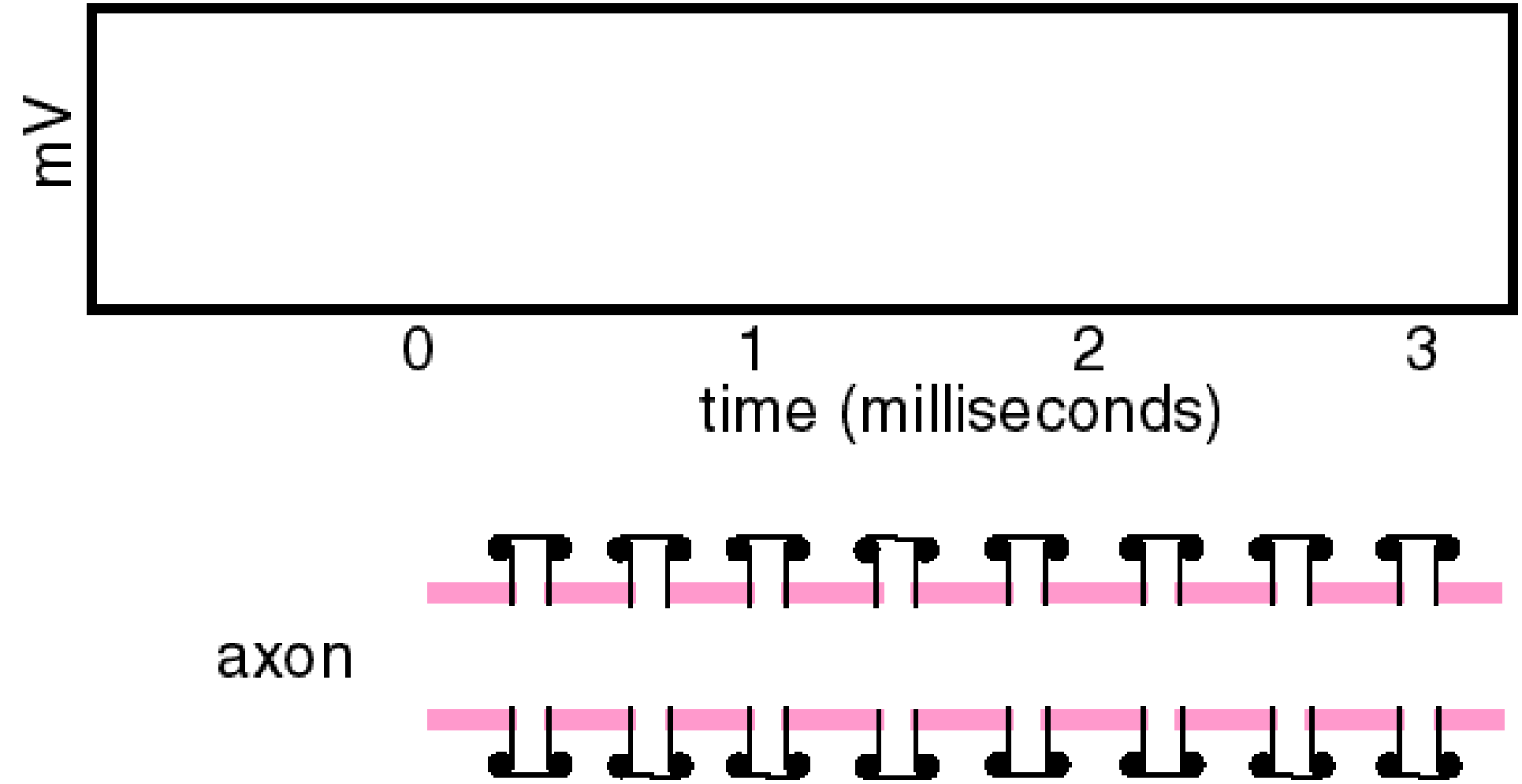

**Stimulation type**

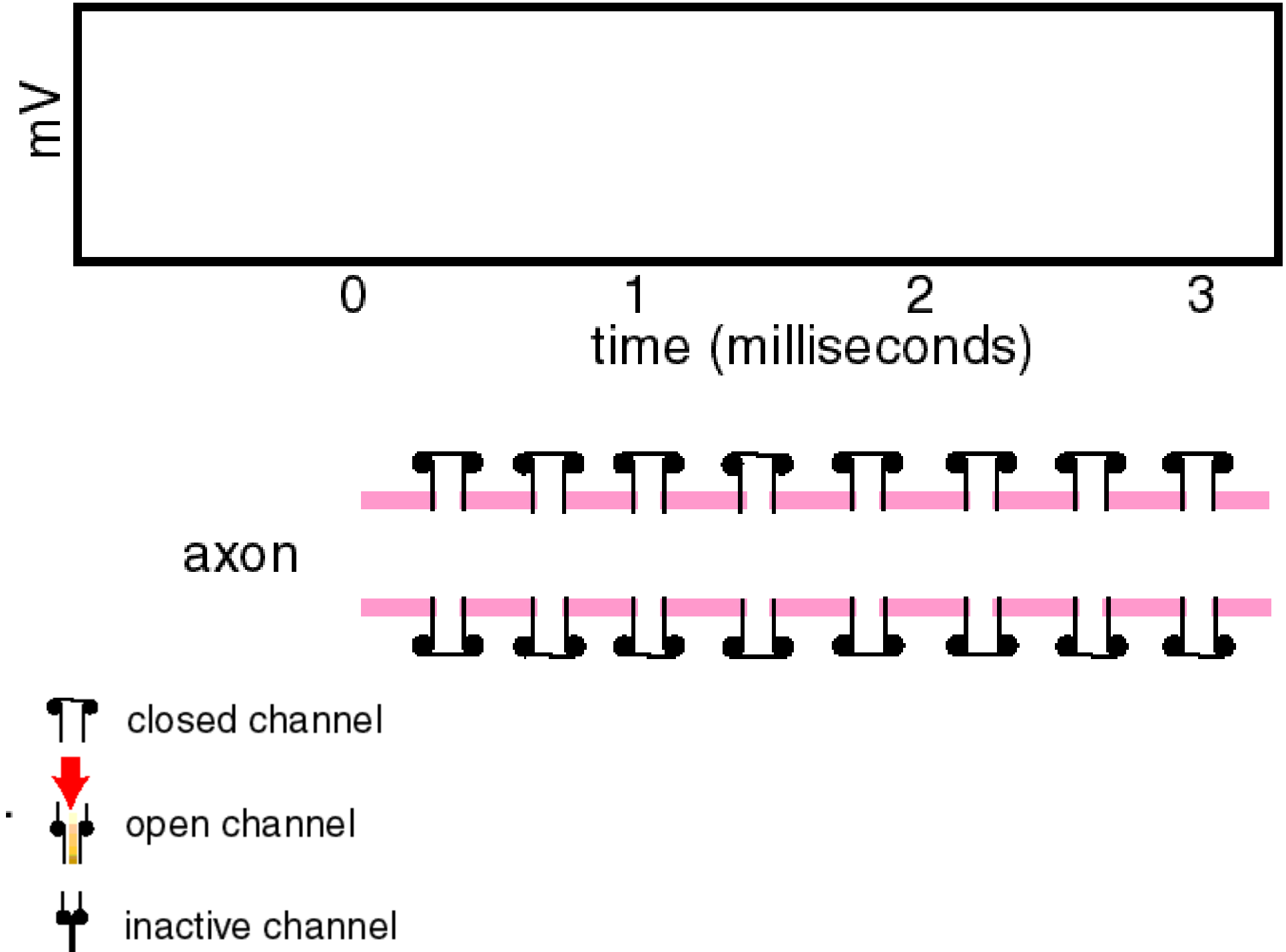



1 action potential requires high, but limited number of ions - considering the whole cell it is capable of producing many action potentials

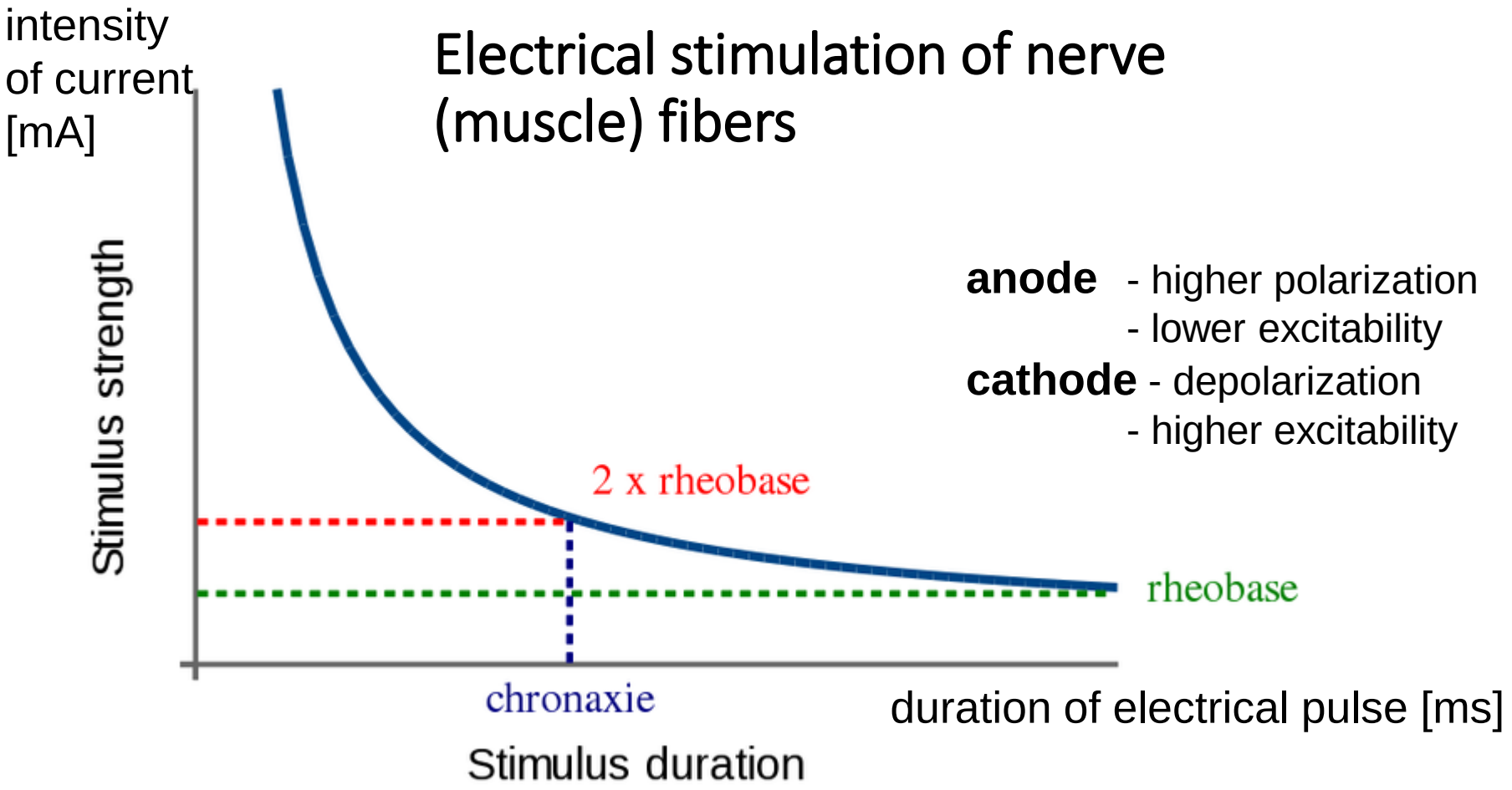
What keeps the ion distribution appropriate?

- Each spike is followed by a **refractory period.**
- An ***absolute refractory period*** - it is impossible to evoke another action potential – during spike and right after it
  (Na channels are open and after that inactivated)
- A ***relative refractory period*** - a stronger than usual stimulus is required to evoke an action potential (hyperpolarization; part of Na channels recovered)


mV
0
1
2
3
time (milliseconds)
axon


mV
0
1
2
3
time (milliseconds)
axon
closed channel
open channel
inactive channel

# Electrical stimulation of nerve (muscle) fibers



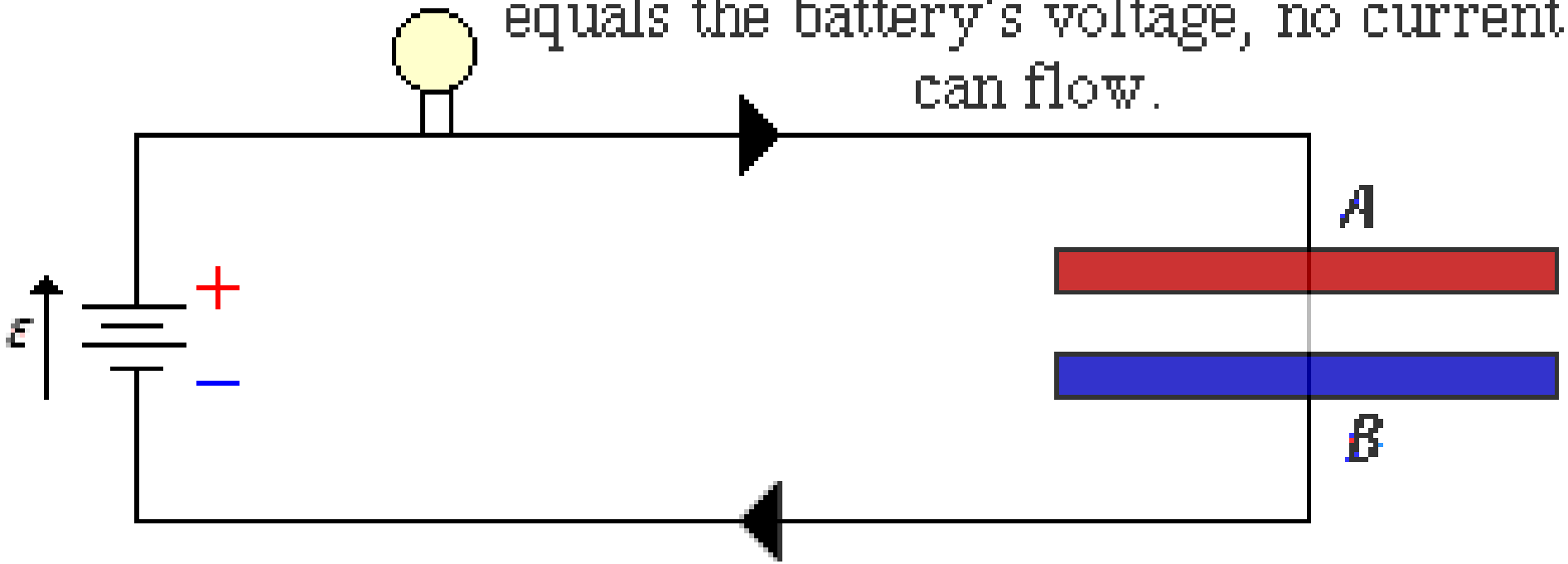

**anode** - higher polarization
- lower excitability

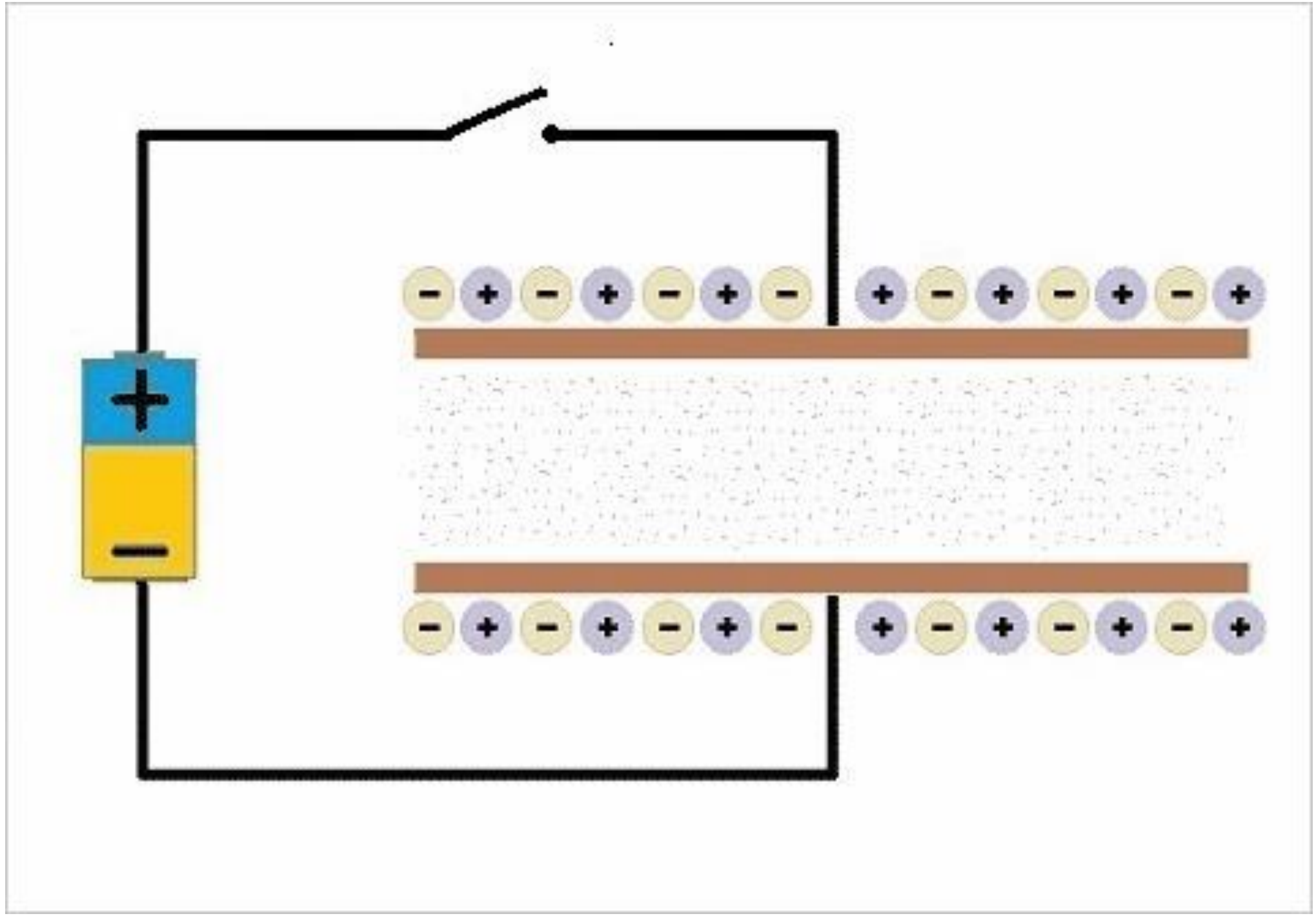
**cathode** - depolarization
- higher excitability

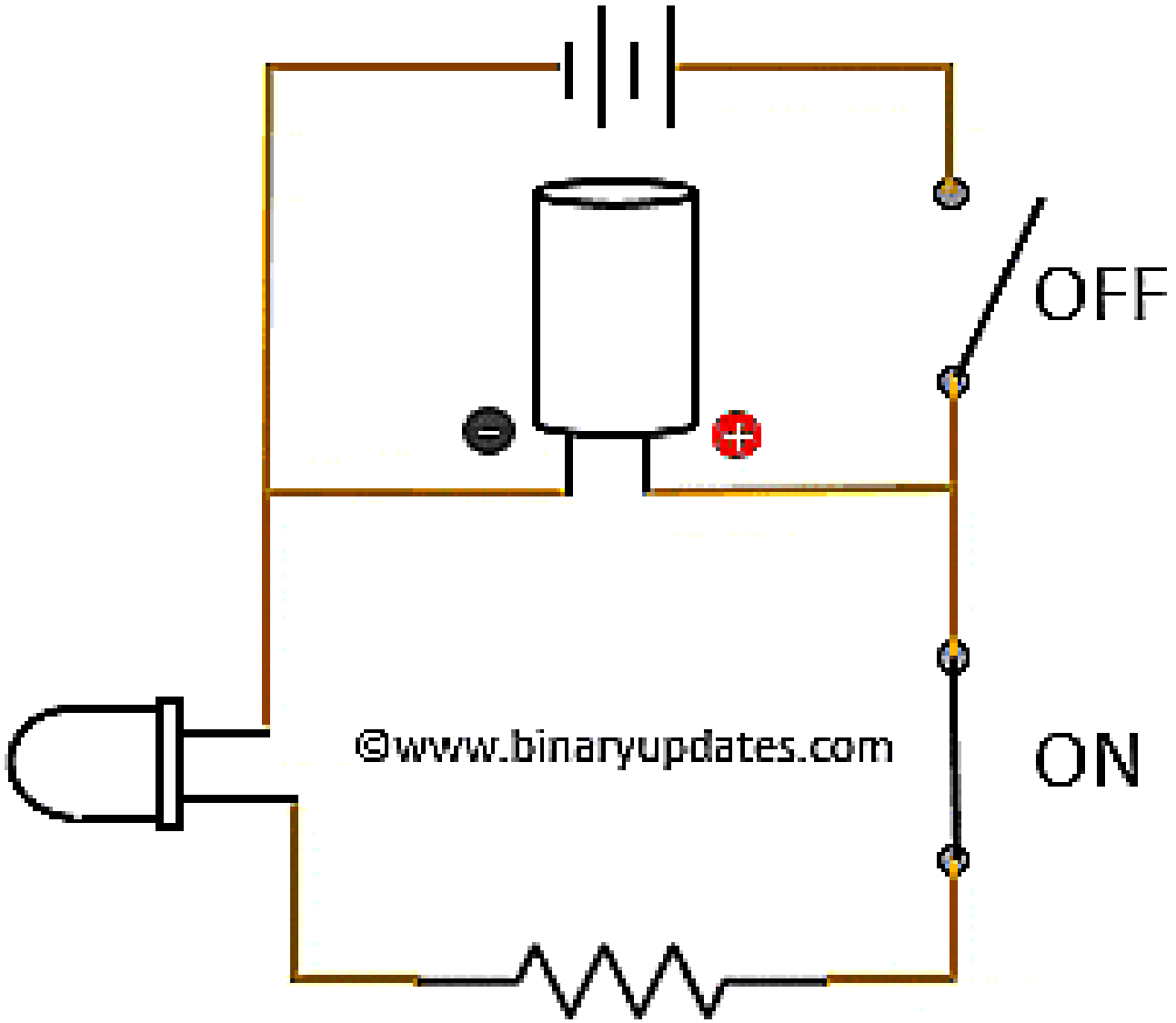
**Rheobase** - minimal current amplitude of infinite duration (practically a few 100 ms) that results in an action potential (or muscle contraction)

**Chronaxy (-ie)** - minimum time over which an electric current double the strength of the rheobase needs to be applied, in order to stimulate a nerve cell (muscle fiber)

When the potential across the capacitor equals the battery's voltage, no current can flow.



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