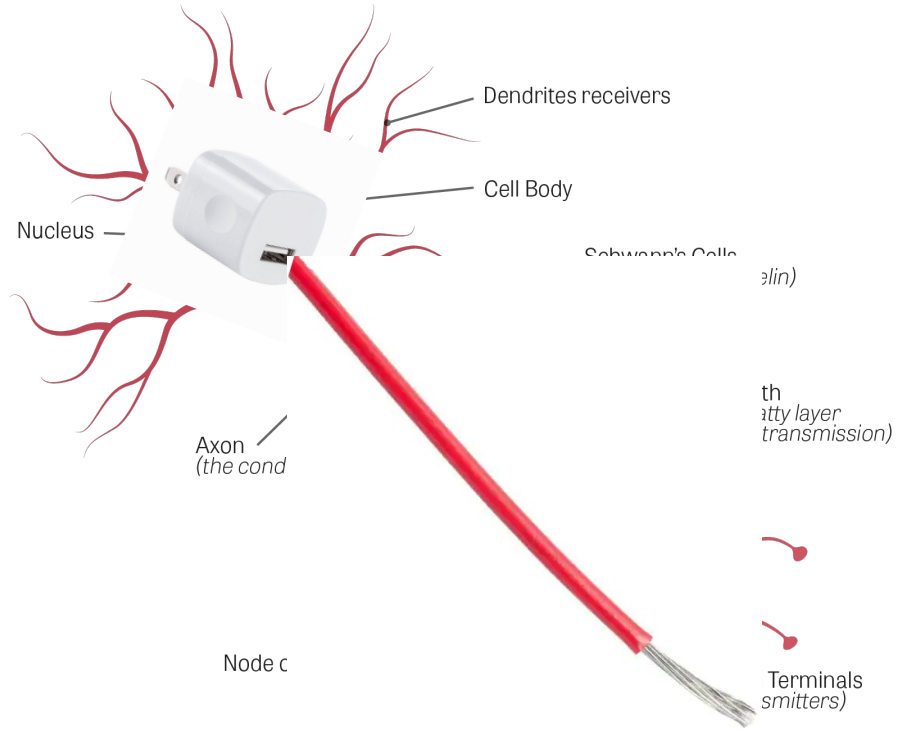


STaRS Contests for Neurons in Action

Amber Burgess, Elijah Noisin, and Dr. Cengiz
Gunay



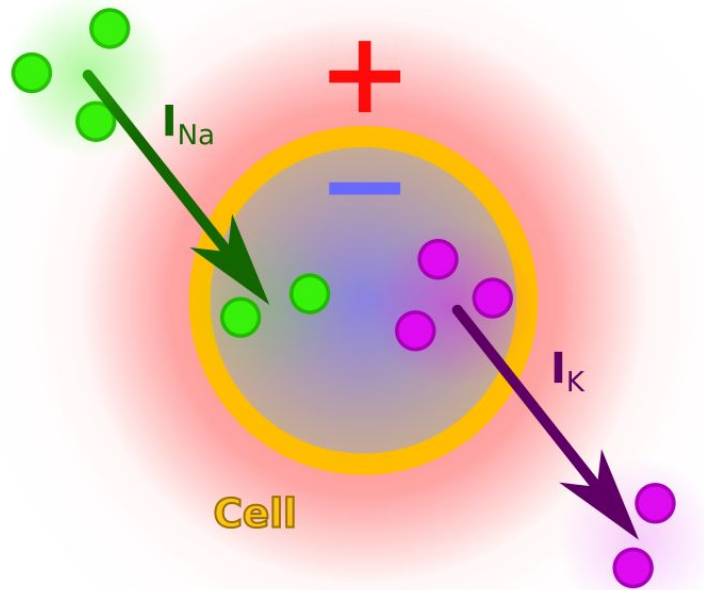
Parts of Neuron



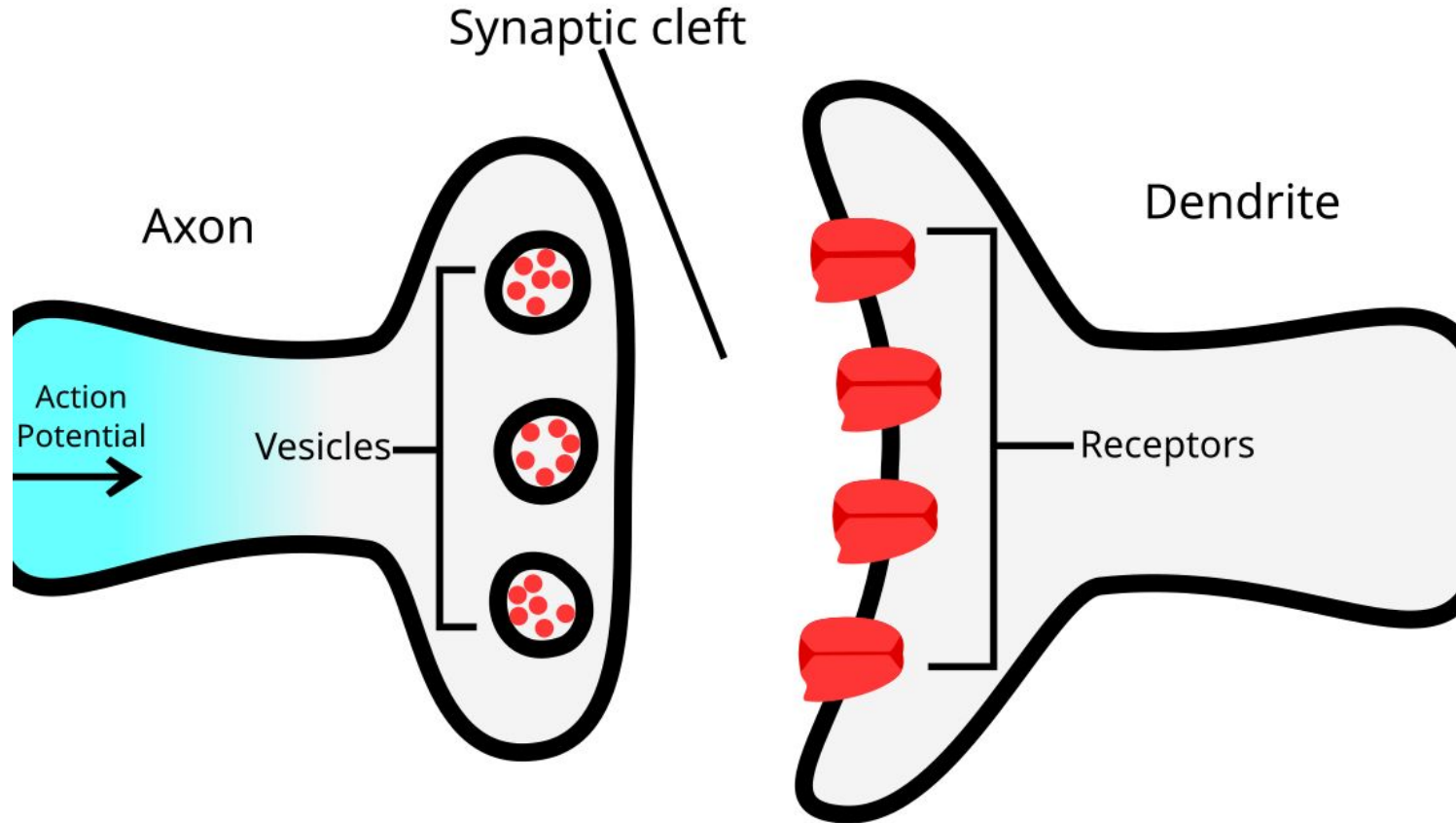
Ions:

Sodium

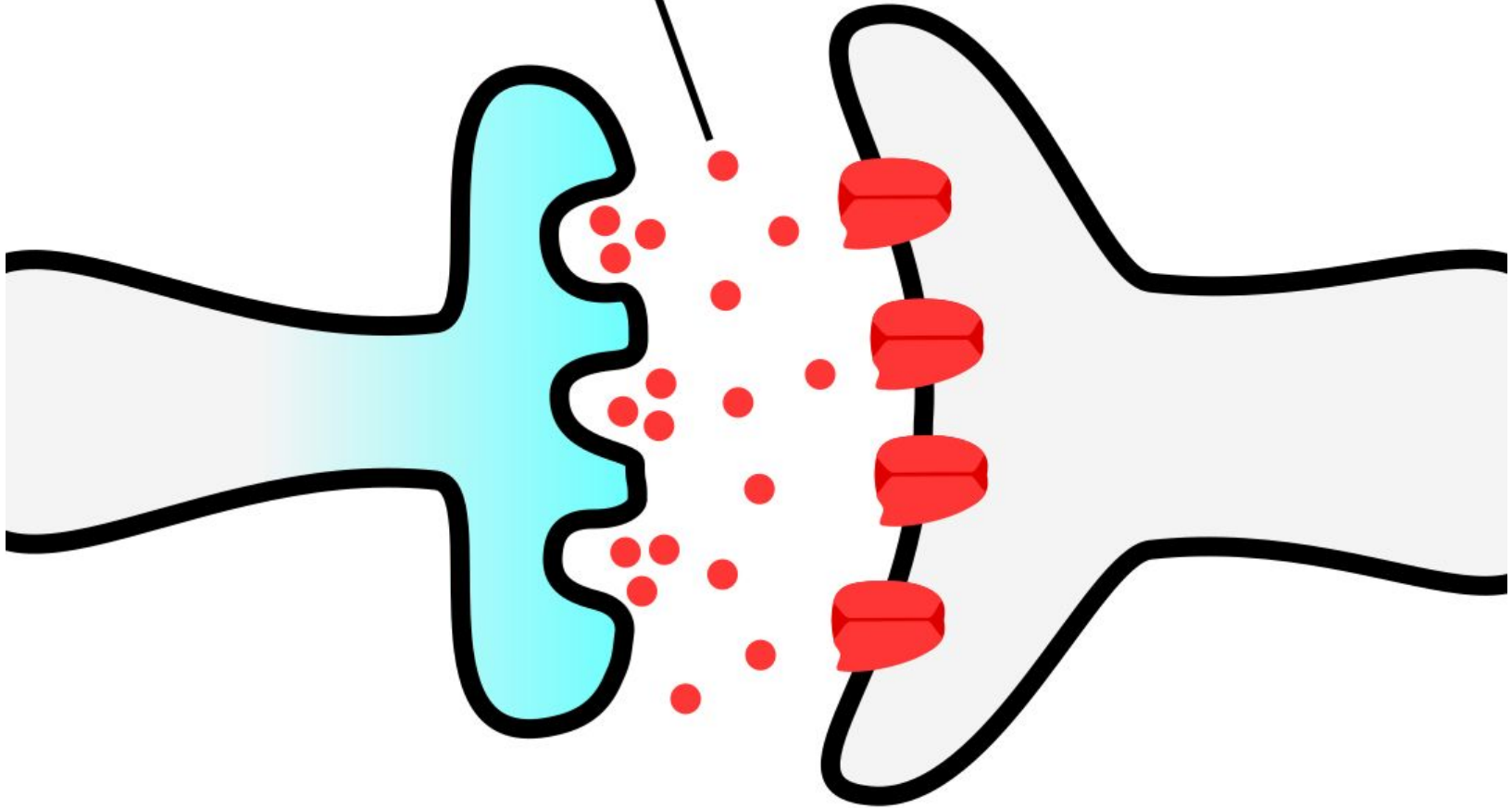
Potassium K^+



Synapse

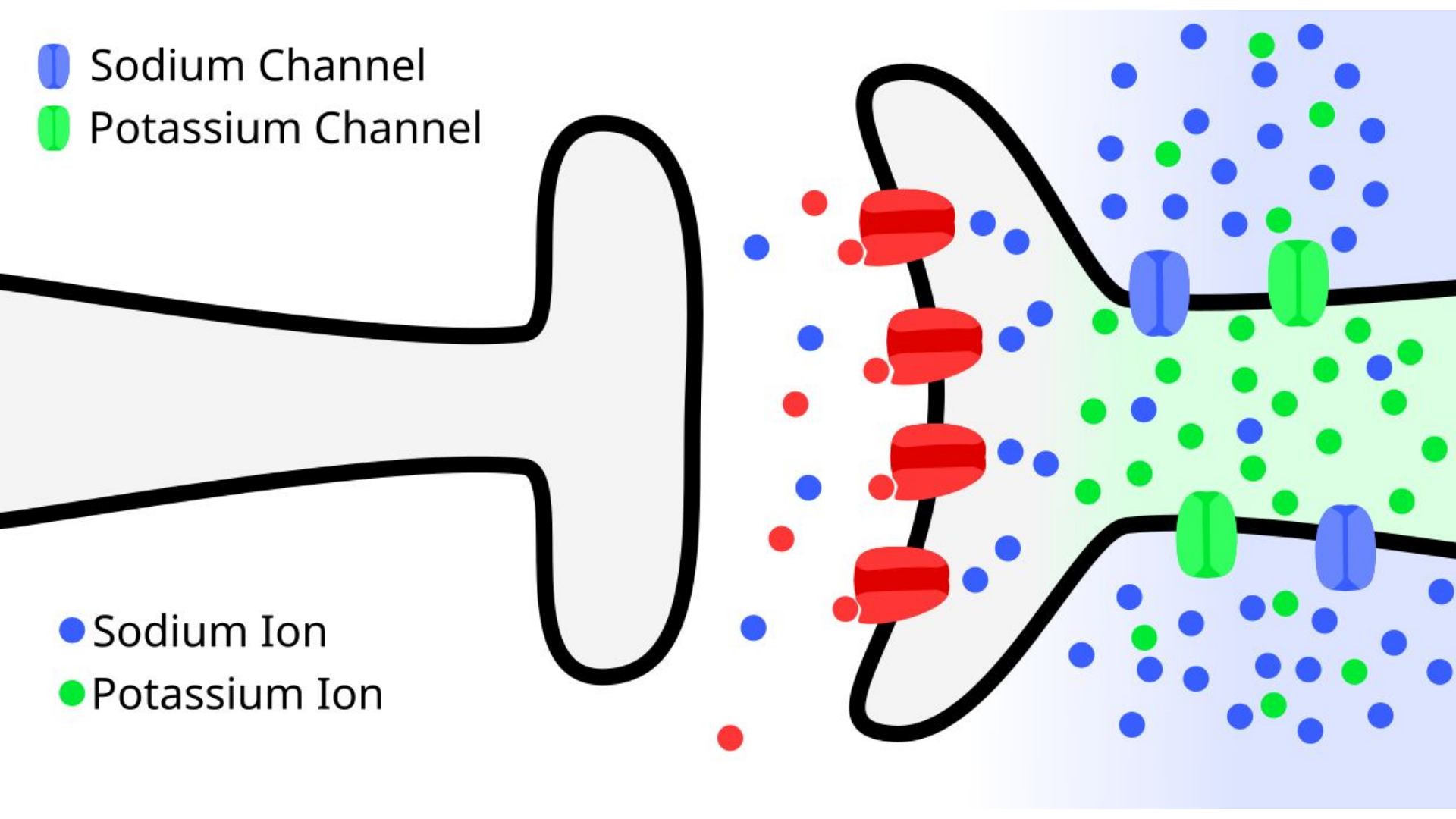


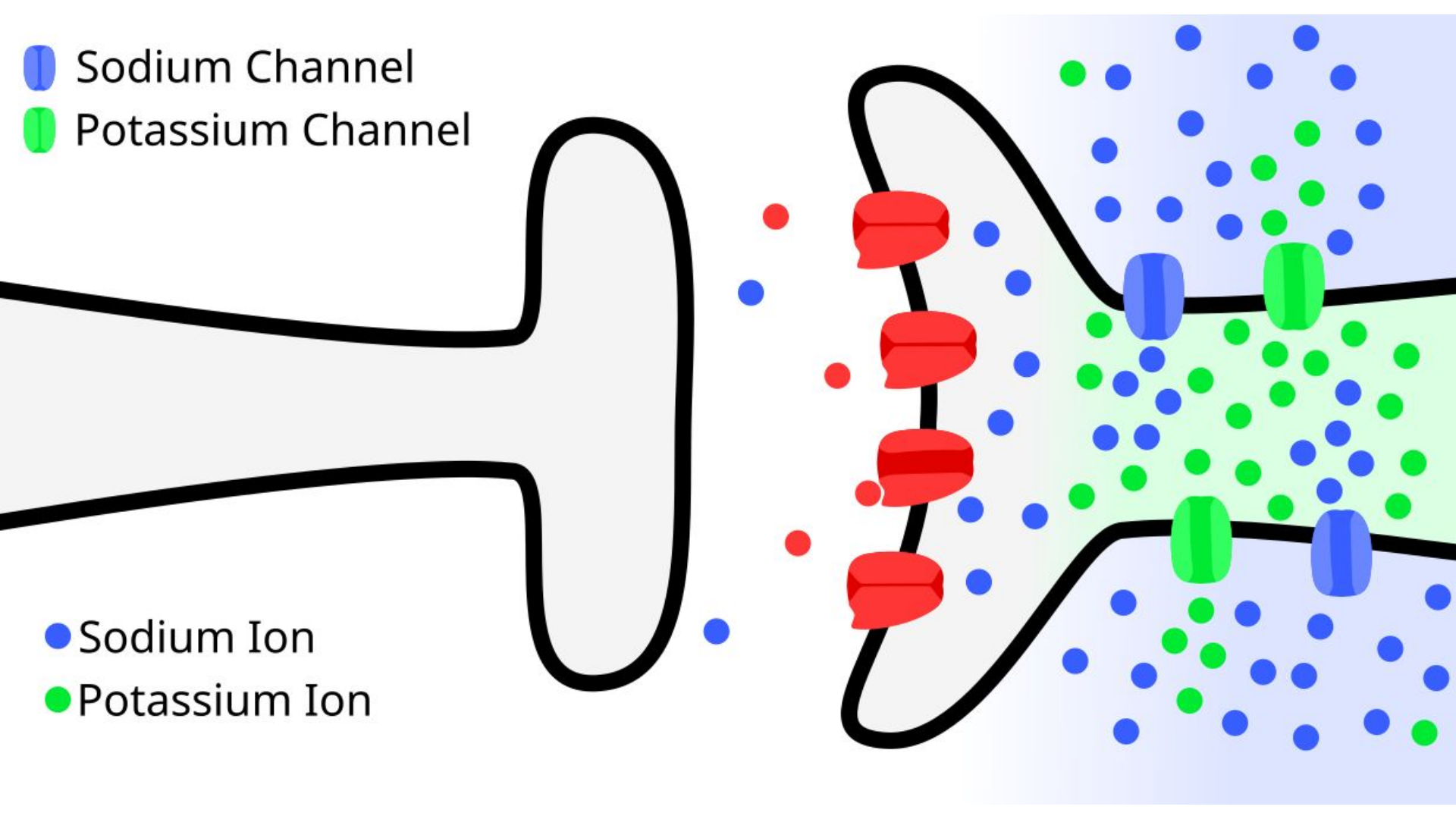
Neurotransmitters



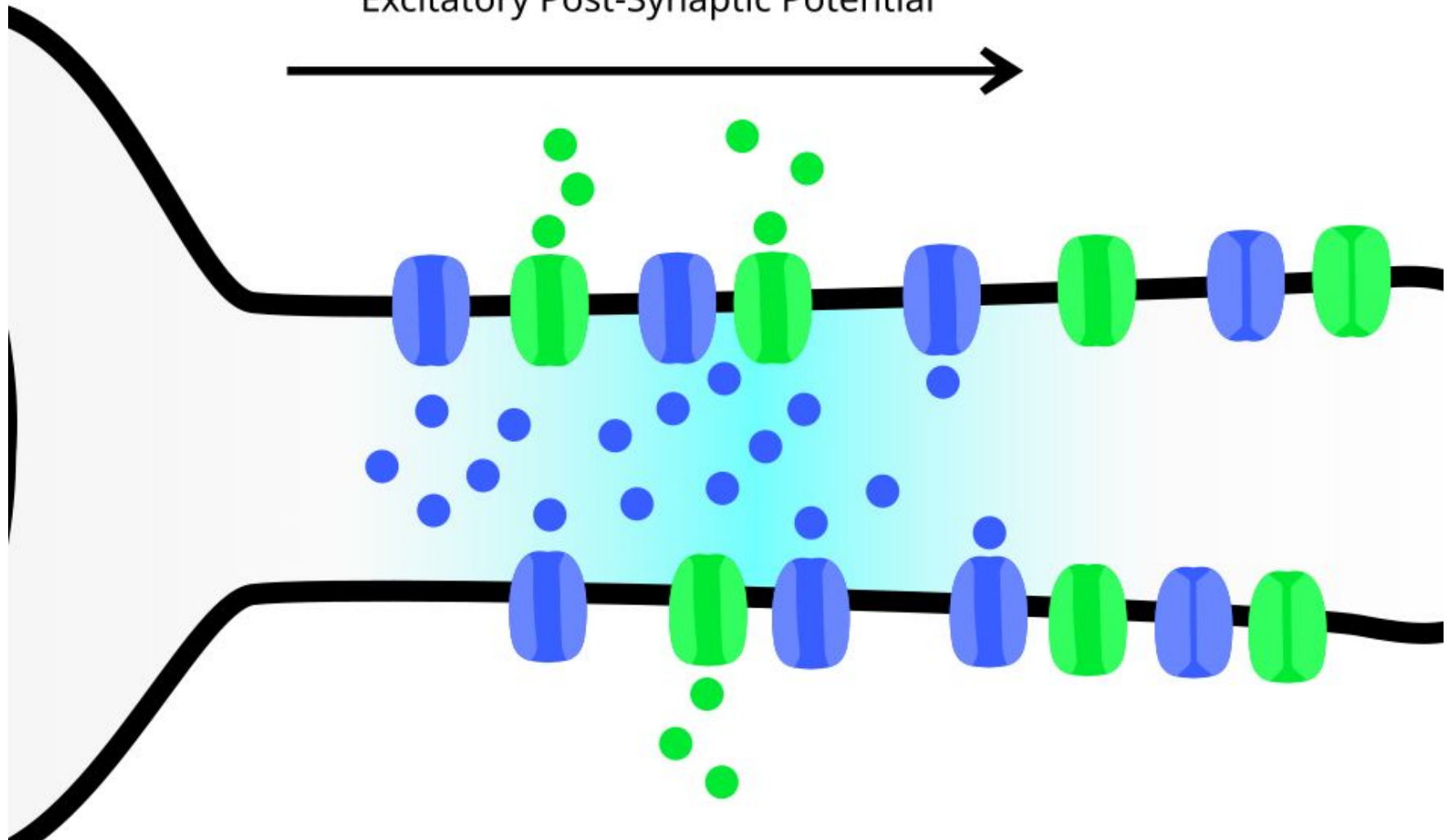
■ Sodium Channel
■ Potassium Channel

● Sodium Ion
● Potassium Ion





Excitatory Post-Synaptic Potential

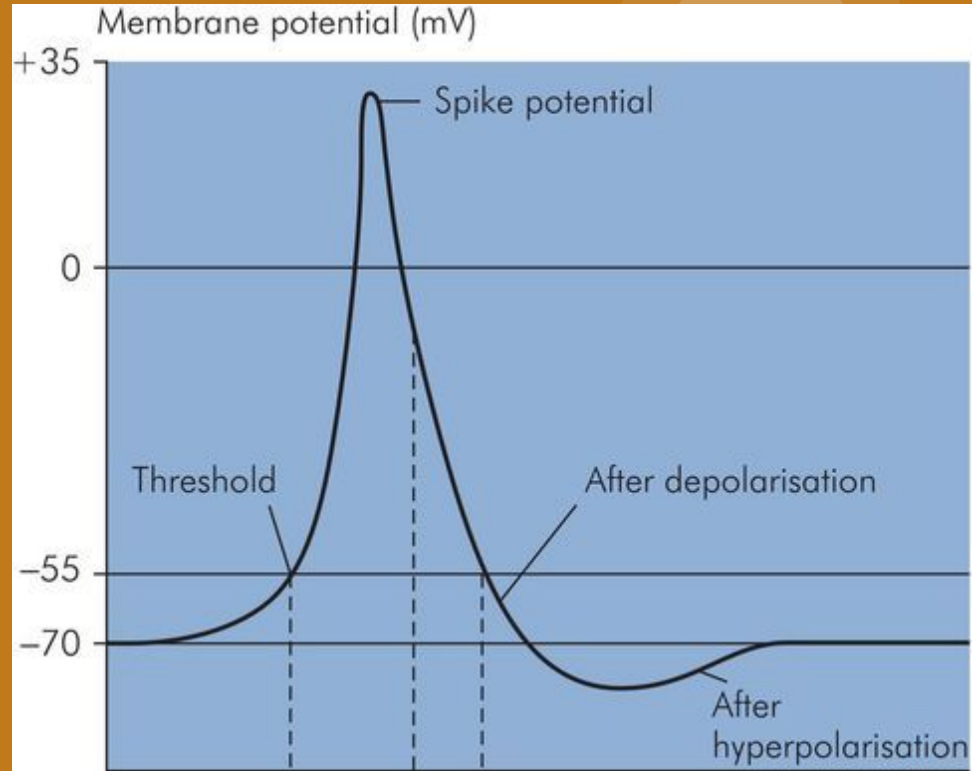


What is an action potential?

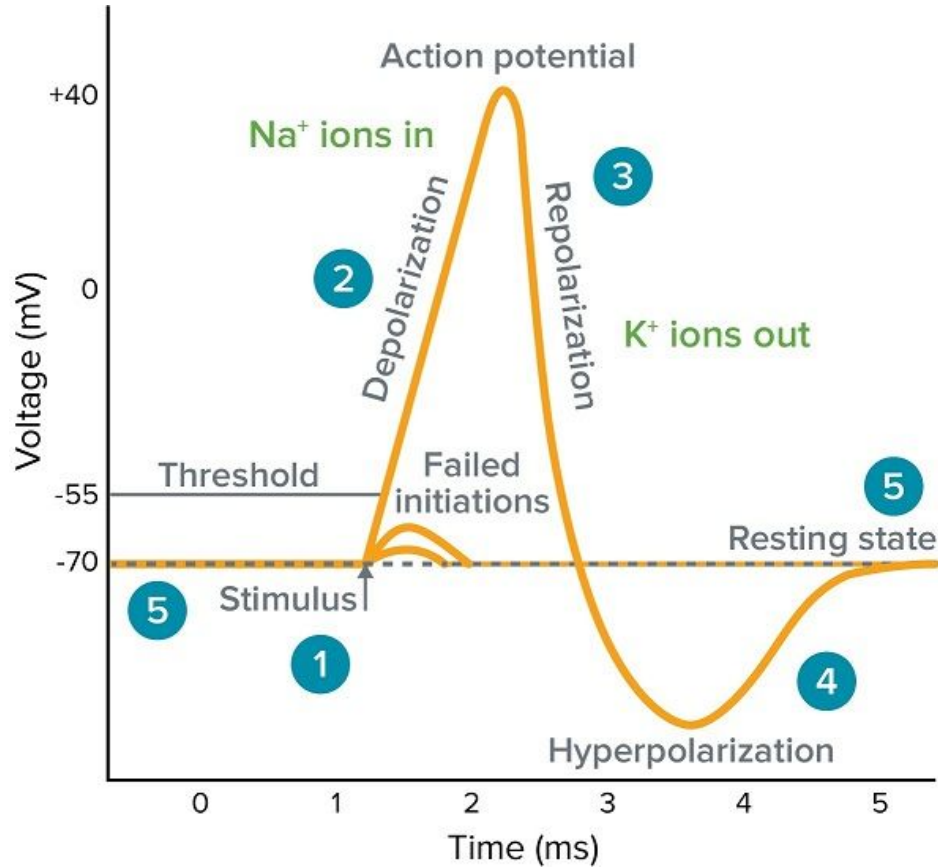
An action potential is the rapid rise and fall of voltage which causes depolarization inside of a neuron.



When do action potentials happen?



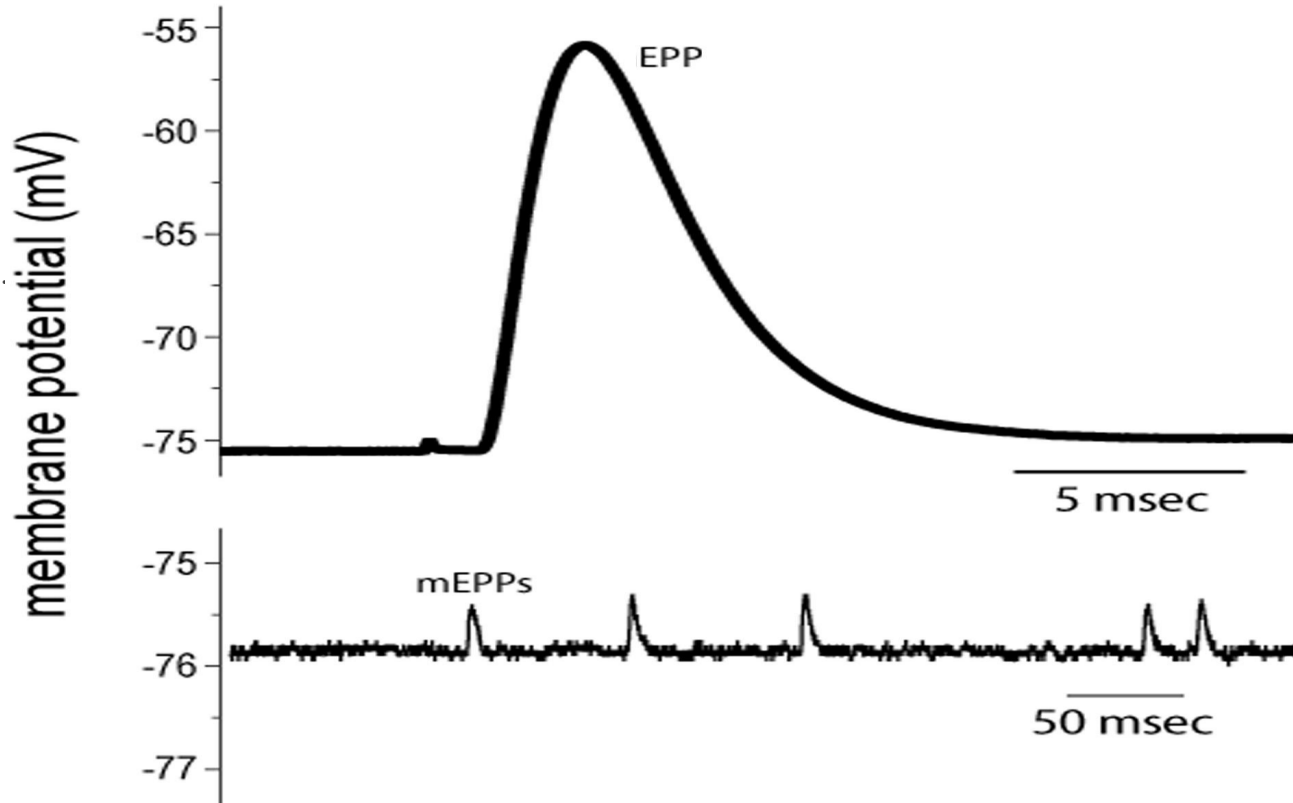
How do action potentials work?





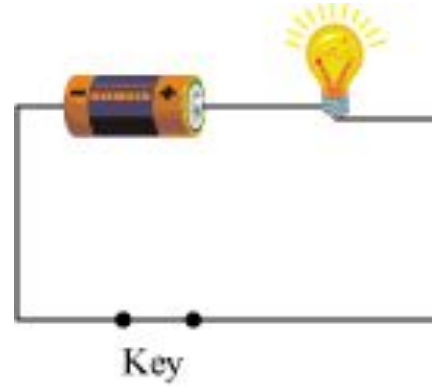


Miniature EPSP or “Mini”

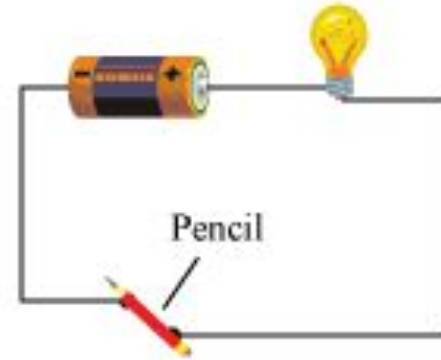


Conductance

The ease of an electrical current to flow through a path.



Key is a good conductor

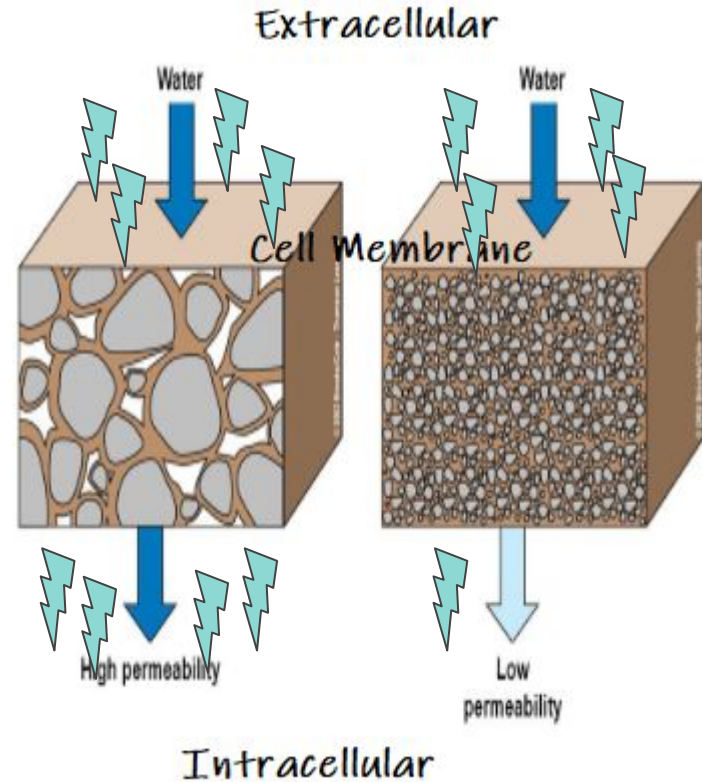


Wood is a bad conductor

Membrane Permeability

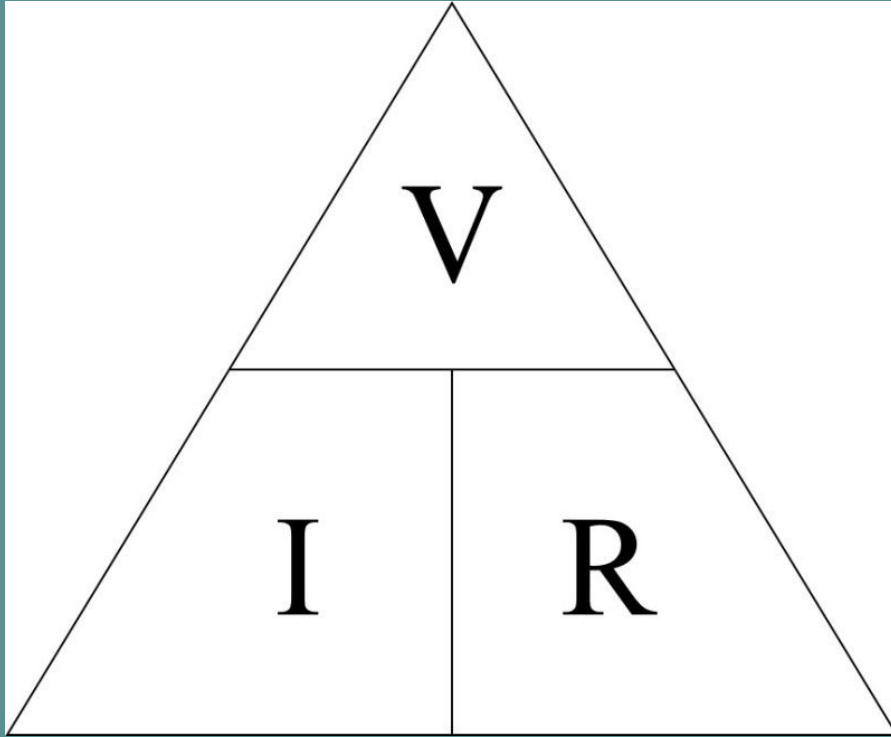
Membrane permeability is the rate of passive movement of molecules (charge/ current).

A high membrane permeability increases the membranes conductance.



**Conductance(g) + Membrane
Permeability(μ) =**

Membrane Conductance

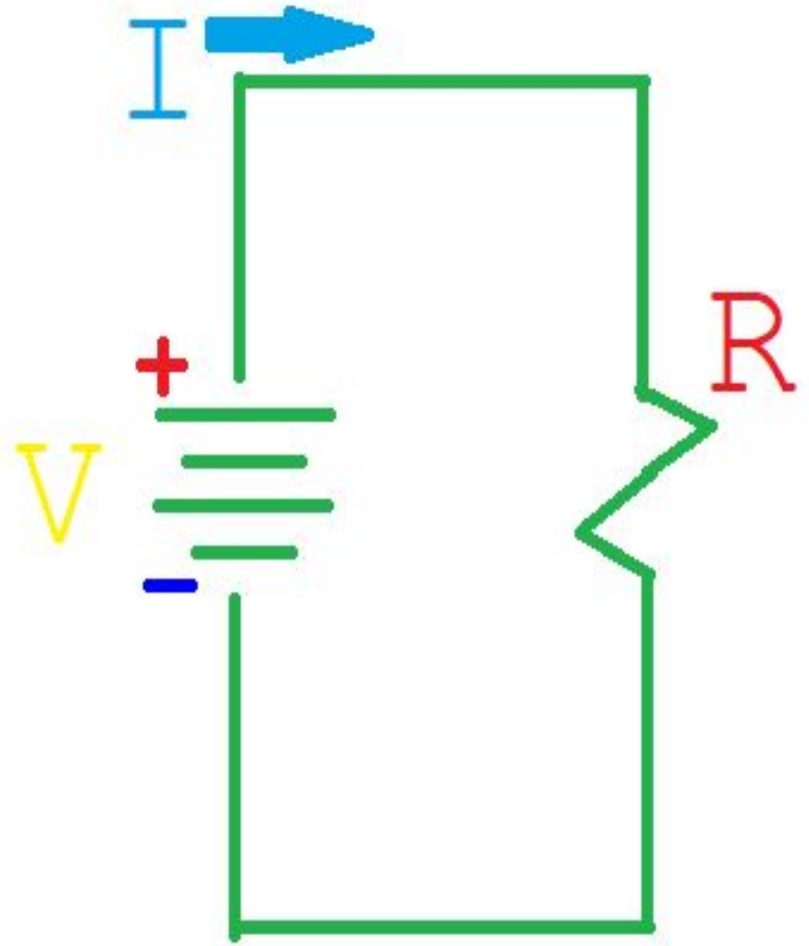


WHAT IS
OHM'S LAW?

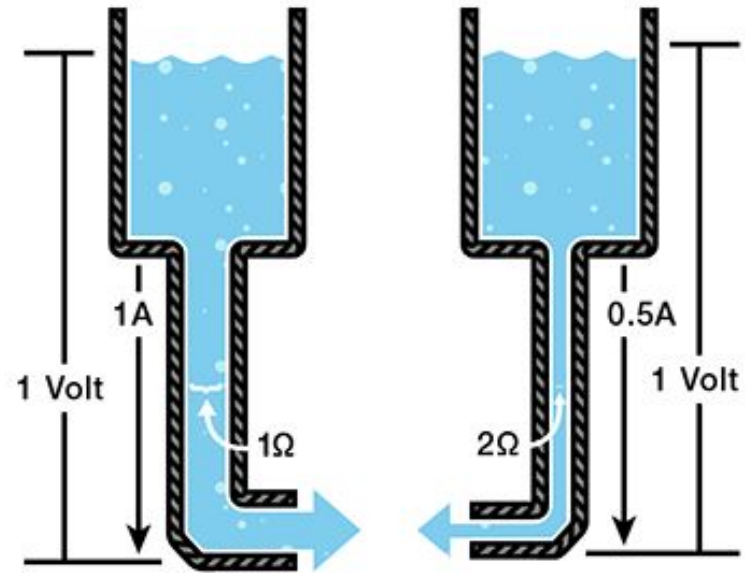
HOW THEY RELATE

If Voltage increases, then
Current increases.

If Resistance increases, then
Current decreases.

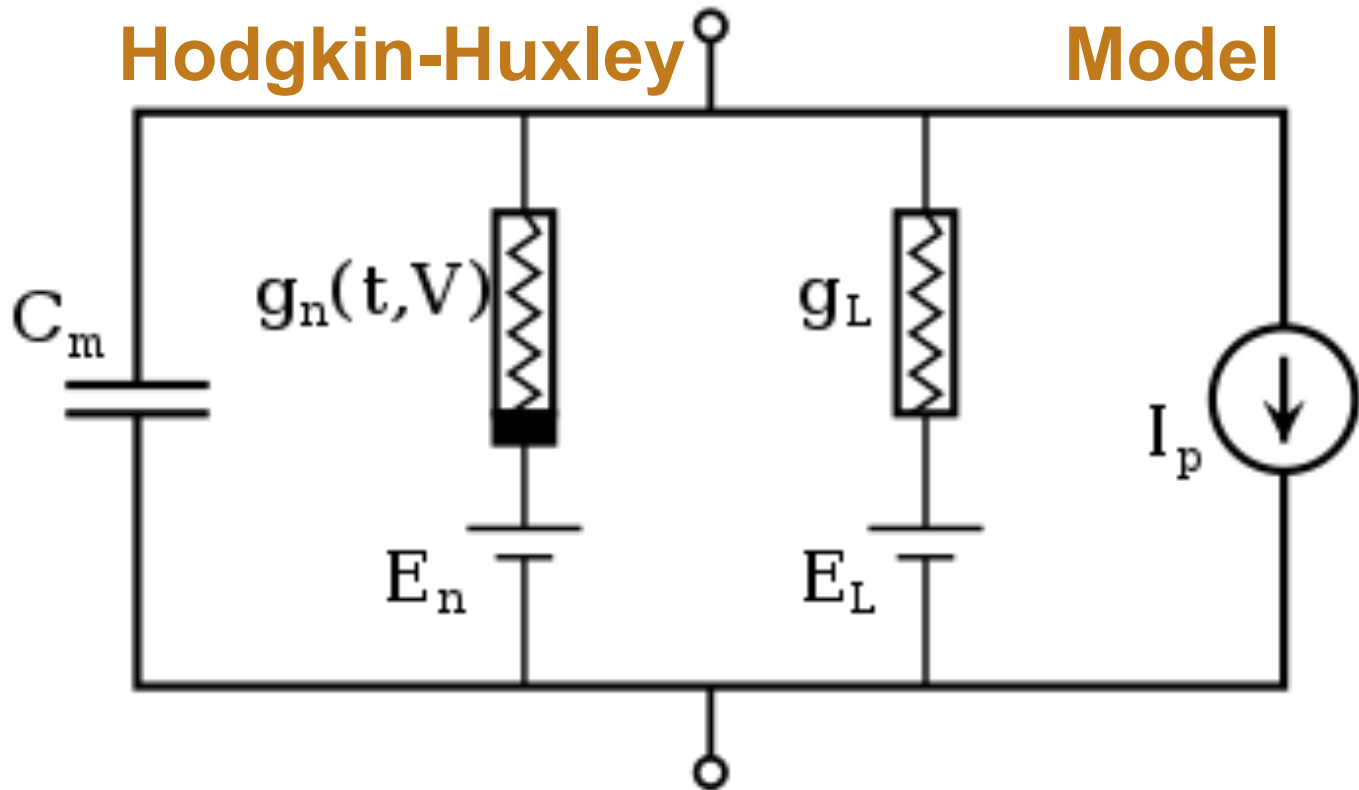


WATER TANK ANALOGY



Extracellular Medium

Hodgkin-Huxley Model



Intracellular Medium



Contest #1: Find the right location for inputs

Difficulty: 2 **Medium Prize**

- Injecting 0.01 nA current to neuron
- Change the injection location (blue ball) on the neuron
- Init & Run to see the result
- Find the location to make it spike 7 times!
- You have 3 minutes



Contest #2: Find the right amount of input

Difficulty: 3 **Grand Prize**

- Start by injecting 0.01 nA current to neuron
- This time, change the injection amount
- Try to make it spike only once!
- You have 3 minutes