**CONCEPT:** ION CHANNELS AND MEMBRANE POTENTIALS

Ion Channels

● **Ion channels** form transmembrane pores that allow for passive transport of small, polar molecules

□ Ion channels are **gated**, meaning that they are not continuously _____

- **Voltage-gated** channels open depending on differences in charge across a membrane

- **Ligand-gated** channels in response to binding of a ligand molecule

- **Mechanically-gated** channels open in response to mechanical force

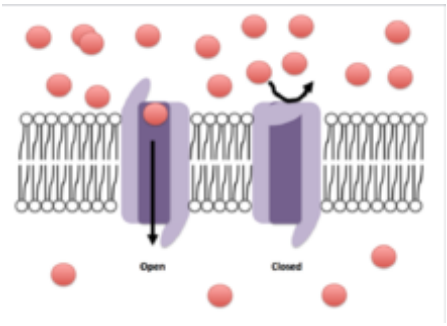
□ Ion channels are _____ and are permeable to a specific ion

- Contain a **selectivity filter** inside a narrow pore which ions must be able to pass

- Ions must disassociate from water in order to pass and only the targeted ion will be able to do this

□ Ion channels move molecules in response to electrical gradients (charge gradients) across the membrane

**EXAMPLE:**




Voltage-Gated


Ligand-Gated

Membrane Potential

● **Membrane potential** is the _____ in environment between the intracellular and extracellular environments

□ Differences in molecular concentration or charge

- **Resting membrane potential** is when the flow of + and – ions across the membrane is balanced

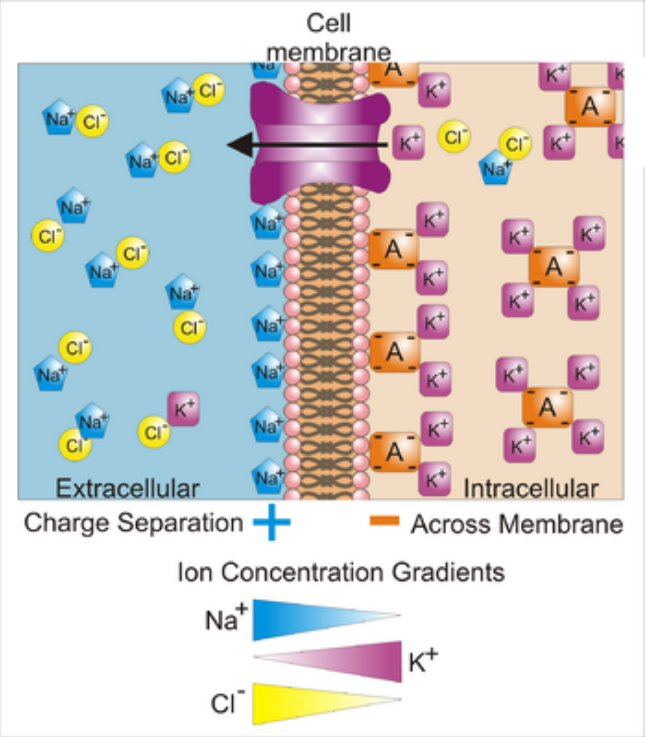
- The charge is balanced, but doesn't necessarily mean it rests at no net charge

□ The **Nernst equation** allows for the calculation and quantification of this difference

□ $Na^{2+}$ $K^{+}$ pump (transporter) creates a large concentration gradient of $Na^{2+}$ and $K^{+}$ across the membrane

- **$K^+$ leak channels** open and close randomly to passively transport of $K^+$ to restore the membrane potential

**EXAMPLE:** Membrane Potential Across a Membrane

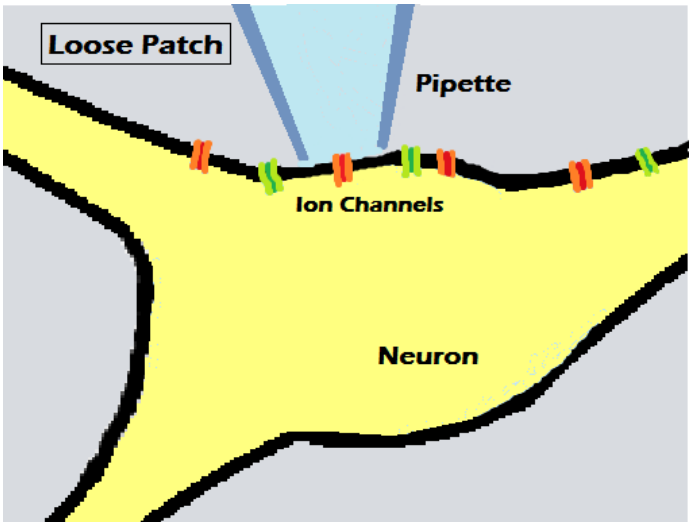



● The **patch-clamp** technique measures the activity of individual ion channels

□ Micropipette isolates a small patch of membrane containing a single ion channel

- Analyzes the flow of ions through the channel

**EXAMPLE:** The patch clamp technique



**PRACTICE**

1. Which of the following is not considered a type of gated ion channel?
    a. Voltage gated
    b. Ligand gated
    c. Mechanically gated
    d. Electrical gated

2. True or False: Ion channels require energy to transport substances across a membrane.
    a. True
    b. False

3. $K^+$ leak channels are important for doing what?
    a. Keeping a steady level of $K^+$ inside the cell
    b. Keeping a steady level of $K^+$ outside the cell
    c. Maintaining a strict concentration gradient across the membrane
    d. Maintaining membrane potential

4. True or False: When the concentration of ions is exactly the same on either side of the membrane, then the cell is at a resting membrane potential.
    a. True
    b. False