**CONCEPT:** MEMBRANE TRANSPORT OF IONS

## Charged Ions Flow Down Electrochemical Gradients

●Direction that charged ions diffuse across membranes depends on its _____ & *electrochemical* gradient.

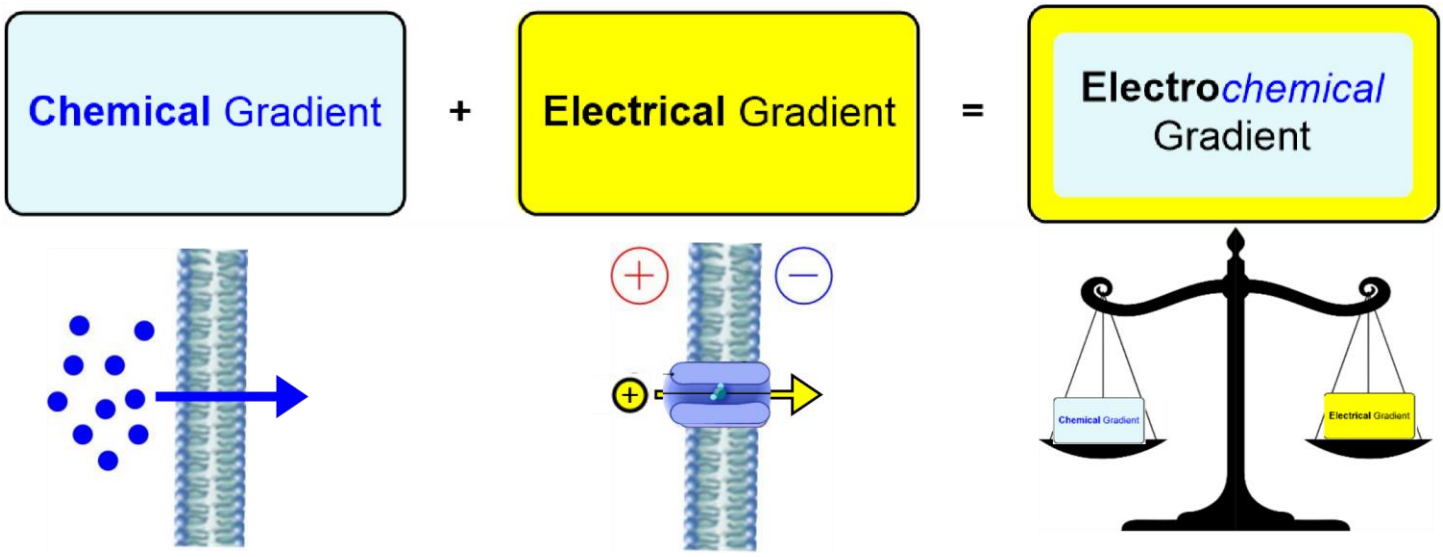
●*Electro-chemical Gradient*: a *combination* & *balance* of the following _____ gradients:

**1)** _____ *gradient*: a difference in *chemical concentration* between two regions.

□ Recall: Chemicals flow *down* their concentration gradients, (from ↑ to ↓) to reach *chemical* ⇌.

**2)** _____ *gradient*: a difference in the sum of *electrical charges* between two regions.

□ Charged ions flow toward _____ charged regions to reach *electrical* ⇌ (net charge = 0).




## Transmembrane Potential

●*Transmembrane Potential/Voltage* ($\Delta\Psi$ or $V_m$): difference in electrical charge between inside & outside of a membrane.

□ *Usually* presented from relative position of inside a membrane & expressed in units of volts or millivolts (V or mV).

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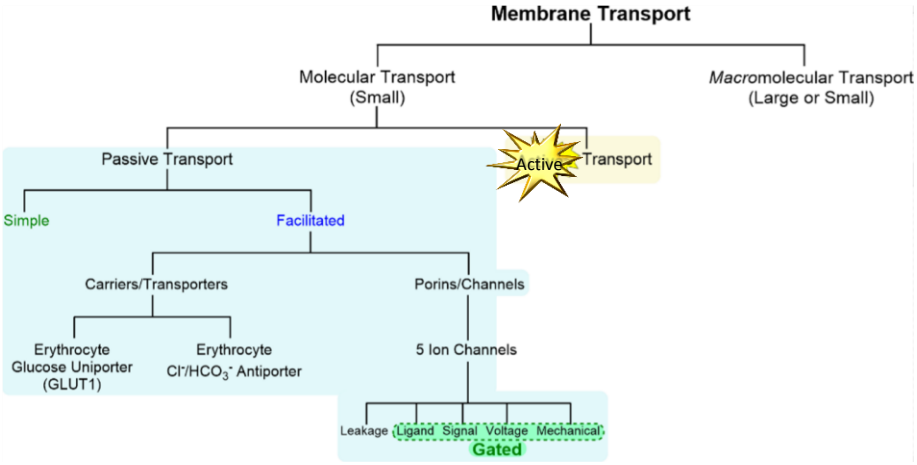
●Generally, *inside* of cells are more _____ with respect to the outside (ΔΨ is *usually* negative).




**Types of Ion Channels**

●Ion channels selectively & passively transport *specific* _____ (such as $Na^+$, $K^+$, and $Cl^-$) across a membrane.

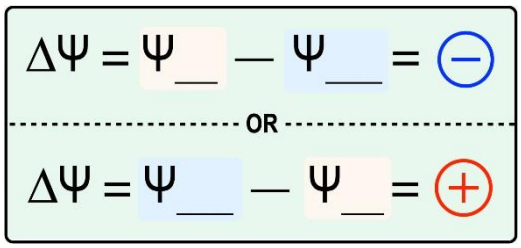
●_____ types of *ion-channels*:

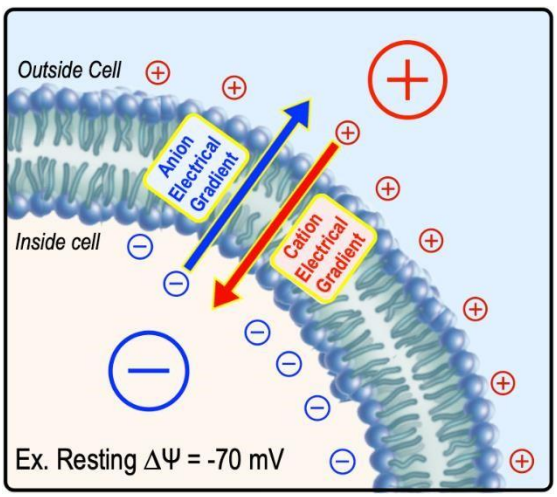
1)_____ Ion Channel: remain open, *always* allowing *leakage* of ions down their electrochemical gradients.

2)_____-*gated* Ion Channel: opens/closes due to regulation by _____cellular *ligand* molecules.

3)_____-*gated* Ion Channel: opens/closes due to regulation by _____cellular *signaling* molecules.

□ When ΔΨ ≠ 0, it establishes *opposite* _____ gradients for *anions* & *cations*



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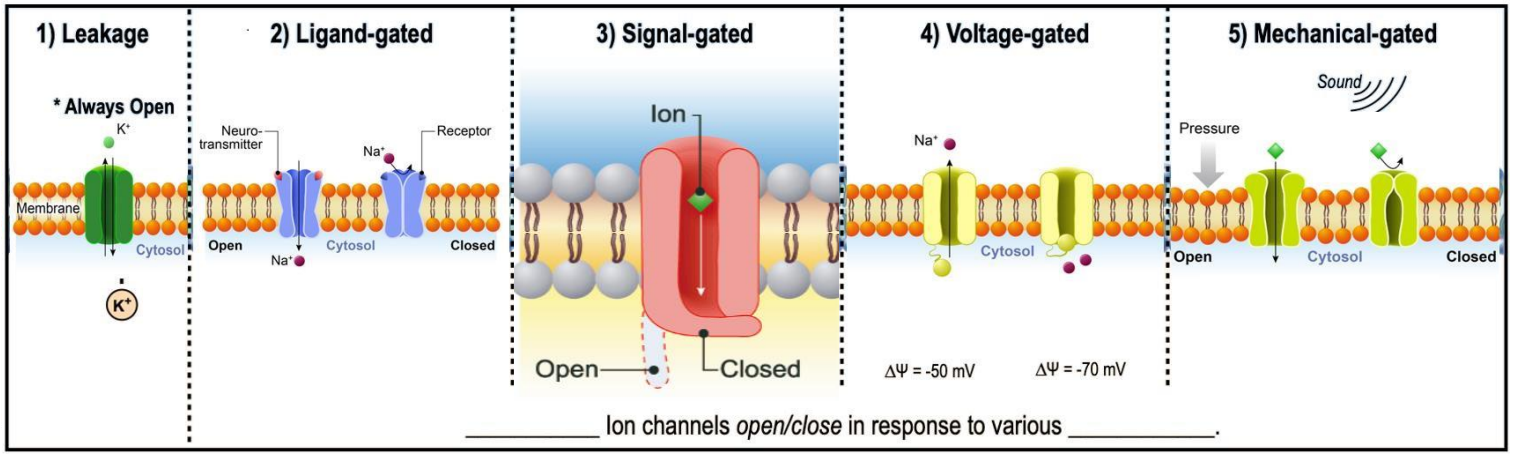
4)_____*-gated* Ion Channel: opens/closes due to changes in *transmembrane*

**5)**_____*-gated* Ion Channel: opens/closes due to *mechanical* stimulation (ex. touch, sound, pressure).




*potential/voltage* (ΔΨ).

**PRACTICE:** Facilitated diffusion of charged ions across a biological membrane is _____: a) Generally irreversible.

b) Endergonic.

c) Driven directly by ATP.

d) Not specific with respect to the type of ion.

e) Driven by a difference in the electrochemical gradient.

**PRACTICE:** Which of the following statements is false about a signal-gated ion channel receptor? a) They are present in the cell membrane.

b) They respond to the presence of intracellular signaling molecules.

c) Differences in membrane potential can affect whether the channel receptors are open or close.

d) They are a type of gated-ion-channel that can open and close under different conditions.

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**PRACTICE:** The voltage-gated potassium channels associated with an action potential provide an example of what type of membrane transport?

a) Simple diffusion.
b) Facilitated diffusion.
c) Coupled transport.
d) Primary active transport.
e) Secondary active transport.