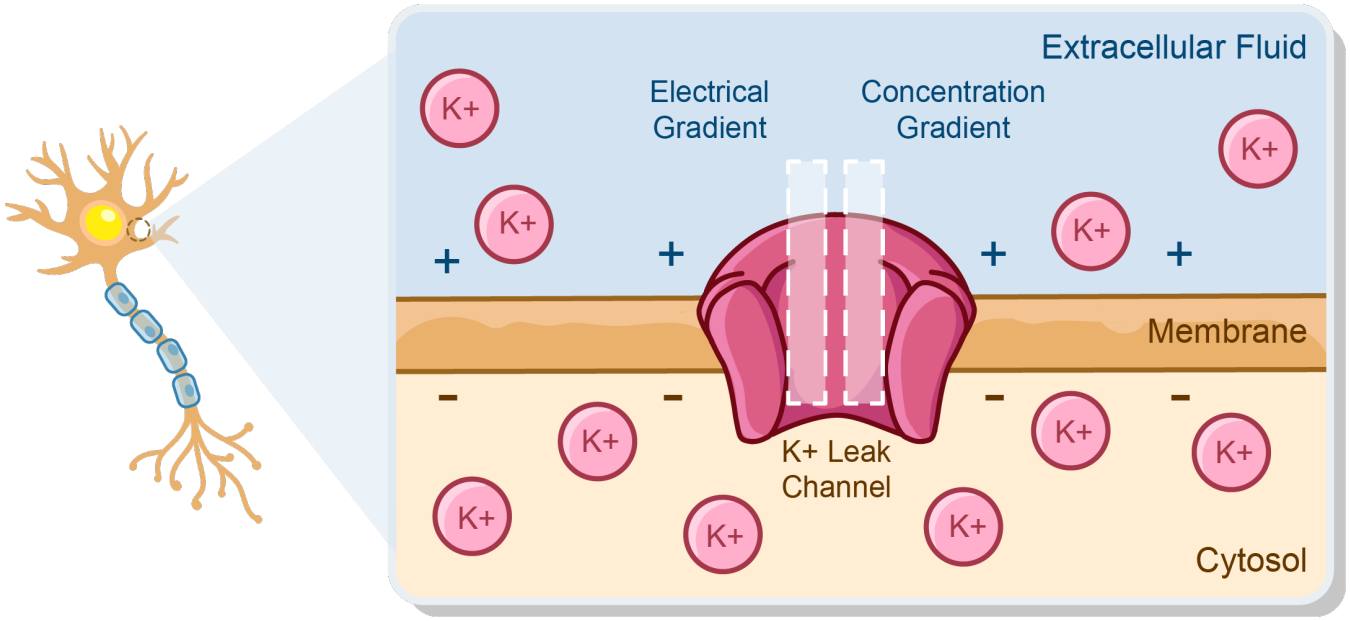
TOPIC: IONS: SODIUM AND POTASSIUM

Electrochemical Gradient

- A combination and balance of two components:
  1. **Electrical gradient**: Ions move toward area of _____charge.
  2. **Concentration gradient**: Ions move from area of _____concentration to area of _____concentration.
- If opposing, whichever gradient is _____drives net flow of ions.

EXAMPLE: Draw an arrow in each box to indicate in which direction the Electrical Gradient and the Concentration Gradient would direct the flow of potassium ions through the K+ Channel.



PRACTICE: Suppose the extracellular fluid has a chloride (Cl-) concentration of 120mM, while the concentration of chloride (Cl-) inside the cytosol is 60mM. Also suppose that the total net charge of the cytosol is more negative than the extracellular fluid. Given this information, which statement is correct regarding the movement of Cl- ions?

a) The electrical and concentration gradients both favor movement into the cell.

b) The concentration gradient favors a net movement out of the cell, the electrical gradient favors movement into the cell.

c) The electrical and concentration gradients both favor movement out of the cell.

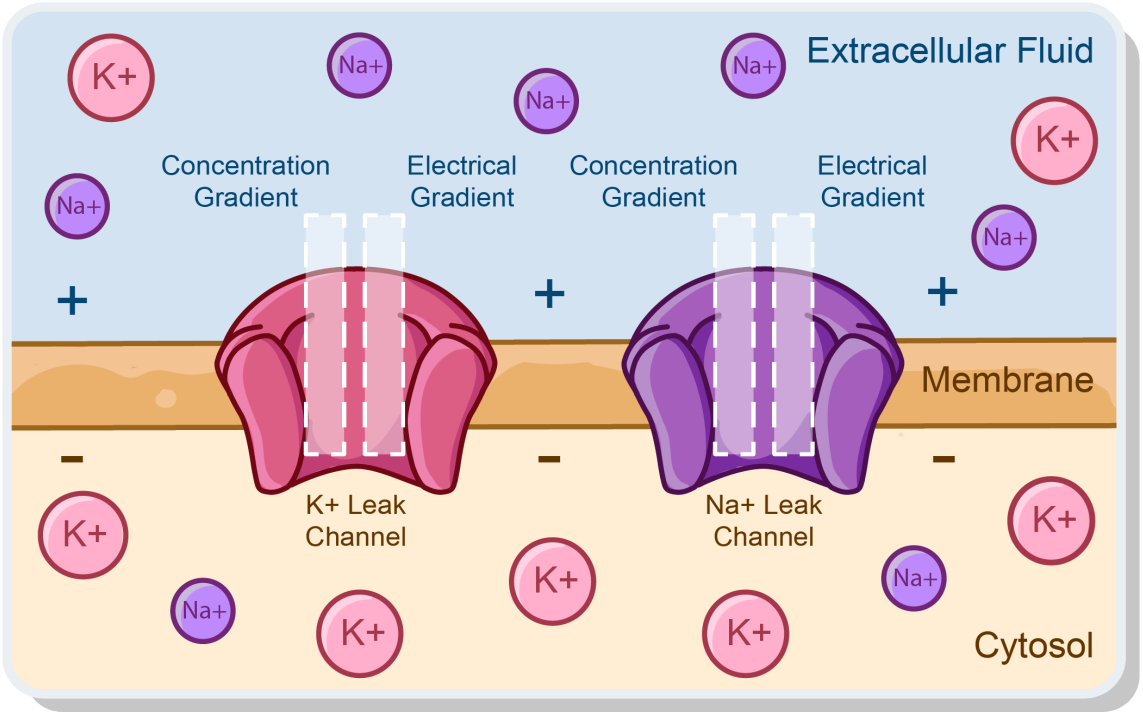
d) The concentration gradient favors a net movement into the cell, the electrical gradient favors movement out of the cell.

TOPIC: IONS: SODIUM AND POTASSIUM

Standard Sodium and Potassium Concentrations

- **Sodium (Na^+):**
  - Intracellular concentration relatively_____.
  - Extracellular concentration relatively ***high***.
- **Potassium (K^+):**
  - Intracellular concentration relatively _____.
  - Extracellular concentration relatively ***low***.

EXAMPLE: Given what you know about Na+ and K+ concentrations, draw an arrow in each box to indicate which direction the Concentration and Electrical Gradients would direct the flow of both sodium and potassium ions.



PRACTICE: In a neuron at rest, the concentration of _____ is higher outside the cell than in the cell, whereas the concentration of _____ is greater inside the cell than outside.

a) Sodium; potassium. b) Potassium; sodium.

PRACTICE: Which of the following statements is true regarding how the concentration gradient affects sodium ions when a cell is at rest?

a) When a cell is at rest the concentration gradient has no effect on sodium ions.

b) The concentration gradient drives sodium ions into the cell.

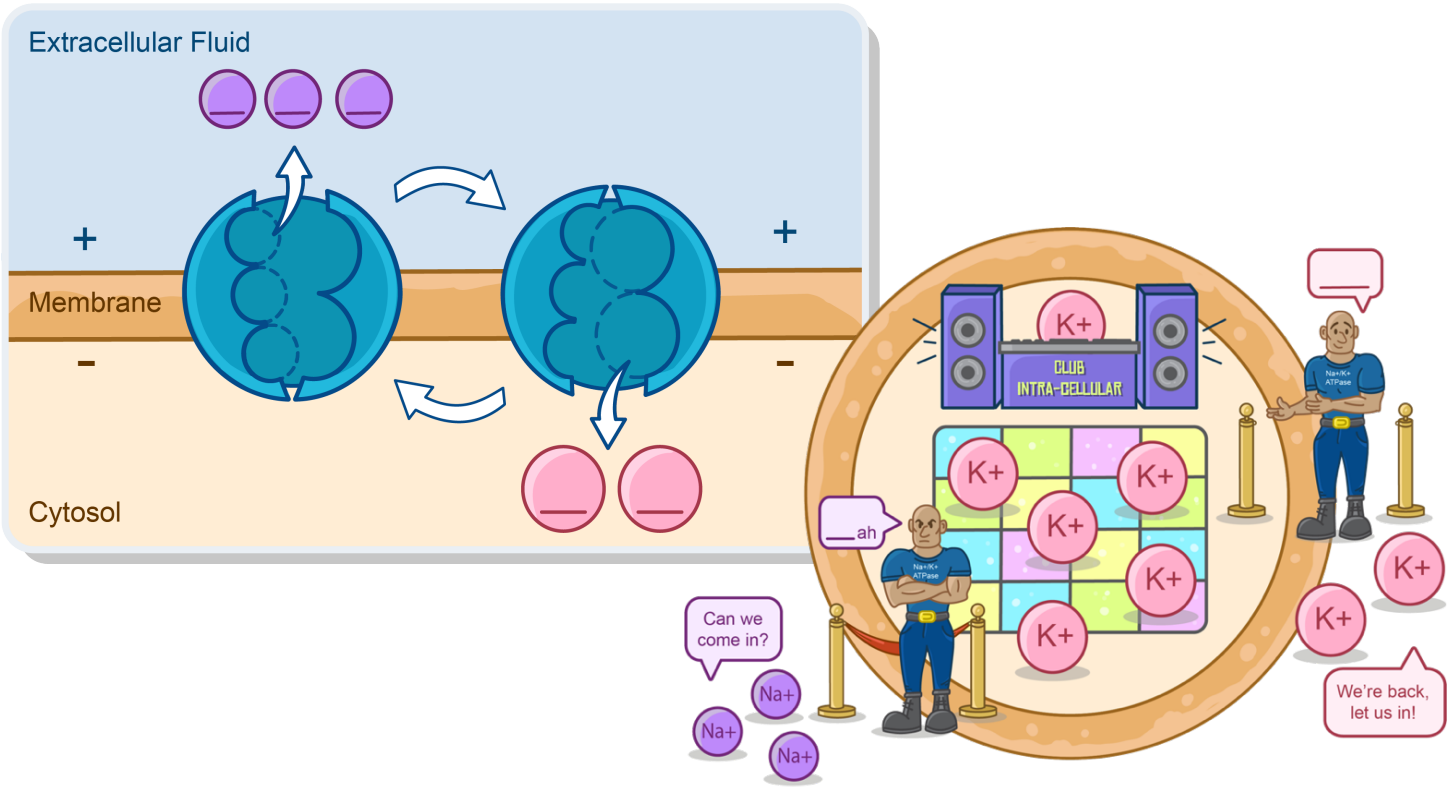
c) The concentration gradient drives sodium ions out of the cell.

d) In a cell at rest the electrical gradient moves ions into the cell.

TOPIC: IONS: SODIUM AND POTASSIUM

The Sodium Potassium Pump (Na+/K+ ATPase)

- *Recall*: Active transport can move ions _____ their electrochemical gradient via ATP-consuming pumps.
- Ejects 3 _____ ions from cell and transports 2 _____ into cell.



EXAMPLE: Terry was injected with a poison that blocks the sodium potassium pump. With the sodium potassium pump blocked, what will happen to the concentration of potassium inside the cell?

a) The concentration of potassium will increase.

b) The concentration of potassium will decrease.

c) The concentration of potassium will be unaffected.

PRACTICE: Which of the following statements about the Sodium Potassium pump is correct?

a) The sodium potassium pump operates as a mechanically gated channel.

b) The sodium potassium pump transports 3 potassium ions and ejects 3 sodium ions.

c) The sodium potassium pump always helps ions move down their natural electrochemical gradient.

d) The sodium potassium pump transports 2 potassium ions and ejects 3 sodium ions.