MEMBRANE POTENTIAL

- plasma membrane exhibits membrane potential
- resting potential
  - electrical voltage difference across the membrane

ACTION POTENTIAL

- with stimulation resting potential can produce responses called action potentials
- resting potential is like voltage stored in a battery
- electric current produced by flow of electrons from negative to positive current
- action potentials occur because plasma membrane contains ion channels that open or close in response to stimuli

ION CHANNELS

- non-gated channels
  - always open
- gated channels
  - open or close in response to stimuli

ION CHANNELS

- plasma membrane has many more K+ non-gated channels than Na+ non-gated channels
  - thus membrane permeability to K+ is higher

GATED CHANNELS
gated channels are stimulated by:

- voltage
- chemicals
- mechanical pressure
- light

RESTING MEMBRANE POTENTIAL

- occurs because of the build-up of negative charges in the cytosol (intracellular fluid)
- equal build-up of positive charges in the extracellular fluid just outside the membrane
- separation of charges represents potential energy measured in millivolts
- large +/- difference = large potential

**RESTING MEMBRANE POTENTIAL**

- potential exists only at membrane surfaces
- resting membrane potential in the neurons is -70mV
- cells with membrane potential are polarized

**RESTING MEMBRANE POTENTIAL**

- factors contributing to resting membrane potential

1) unequal distribution of ions across the plasma membrane

   - ECF - rich in Na⁺ and Cl⁻
   - ICF - K⁺ and PO₄⁻, amino acids -

2) relative permeability of the cell membrane to Na⁺ and K⁺

   - resting neuron permeability 50-100 times greater to K⁺ than to Na⁺
MEMBRANE PERMEABILITY

- cell membrane has a low permeability for Na+ from outside of cell and Pr- inside cells
- membrane has high permeability to K+ to move out of cell
- tendency for K+ to move from inside the cell to outside down the concentration gradient
- as K+ move out Na+ move down its concentration gradient into the cell

MEMBRANE PERMEABILITY

- this has the effect of balancing electrical effect of K+ outflow
  - but Na+ inward flow is too slow to keep up with K+ outflow
- net effect of K+ outflow is that the inner cell membrane surface becomes more negative

Na+/K+ PUMPS

- both electrical and concentration gradients promote Na+ inflow
  - small inward Na+ leak is taken care of by Na+/K+ pumps
  - maintain resting membrane potential by pumping out Na+ as fast as it leaks in

Na+/K+ PUMPS

- Na+/K+ pumps bring in K+
  - K+ redistributes immediately because it is permeable to the membrane
- thus the critical job of the Na+/K+ pumps is to expel Na+
- total effect is -70 mV resting membrane potential