## 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
- seperation 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 $PO_4^-$, 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 immeadiately 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