MEMBRANE POTENTIAL AND NERVE IMPULSE TRANSMISSION

- Resting neurons maintain a difference in electrical charge across their cell membranes
- The inside of the resting neuron is negatively charged, the outside is positively charged
- When a neuron is stimulated this polarity is reversed, these reversals are called action potentials

ACTION POTENTIAL

- Nerve impulses are conducted along the neuron by a wave of membrane polarity reversals (action potentials)
- Chemical messengers (neurotransmitters) carry nervous impulses from one neuron to another across the synapse
THE NEURON MEMBRANE AT REST

- Neuron maintains a resting membrane potential of about -70 millivolts across the cell membrane
- Sodium(Na+) and potassium(K+) are the main ions involved

✓ Na+ and K+ cannot pass through the lipid bilayer membrane
✓ move through the membrane by using membrane proteins (pumps)

MEMBRANE PROTEINS
Membrane proteins do several things:

- Some "leak" ions all the time
- Some "leak" ions only when the cell has been stimulated (ion "gates")
- Some "pump" ions by active transport

**Na⁺ / K⁺ PUMP**

Membrane proteins actively transport

- sodium out of the cell
- potassium in

- Three Na⁺ are pumped out for every two K⁺ pumped in

result is the cell has more Na⁺ on the outside and more K⁺ on the inside

The pumping of Na⁺ out makes the outside more positive and the inside of
the cell more negative

STIMULATED NEURON

- Nerve cells are unique in their ability to carry a signal using membrane potential changes
- Stimulation of a neuron opens some of the membrane proteins (a.k.a. Na+ gates)
  - allows Na+ to pass freely into the cells
- free flow of Na+ into the cell causes a reversal of membrane polarity
  - polarity reversal is called the action potential
ACTION POTENTIAL

- reversal of polarity (action potential) moves along the cell like a wave
- the membrane restores the resting potential very quickly

✓ less than 7 milliseconds
✓ The cell can be stimulated again
ALL-OR-NONE RESPONSE

- once a threshold limit is reached any stronger stimulus will not increase the cell's response
- A stimulus below the threshold also will not stimulate the neuron

SYNAPSE
neurons communicate across the synapse by using chemical messengers called neurotransmitters.

- Neurotransmitters may act to inhibit neurons or to excite neurons.
- Attachment of the neurotransmitters to presynaptic membrane receptors causes ion channels to open.

✓ Generate an action potential.