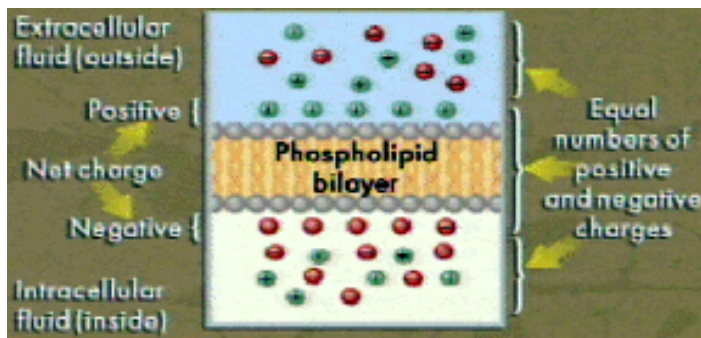


MEMBRANE POTENTIAL AND NERVE IMPULSE TRANSMISSION

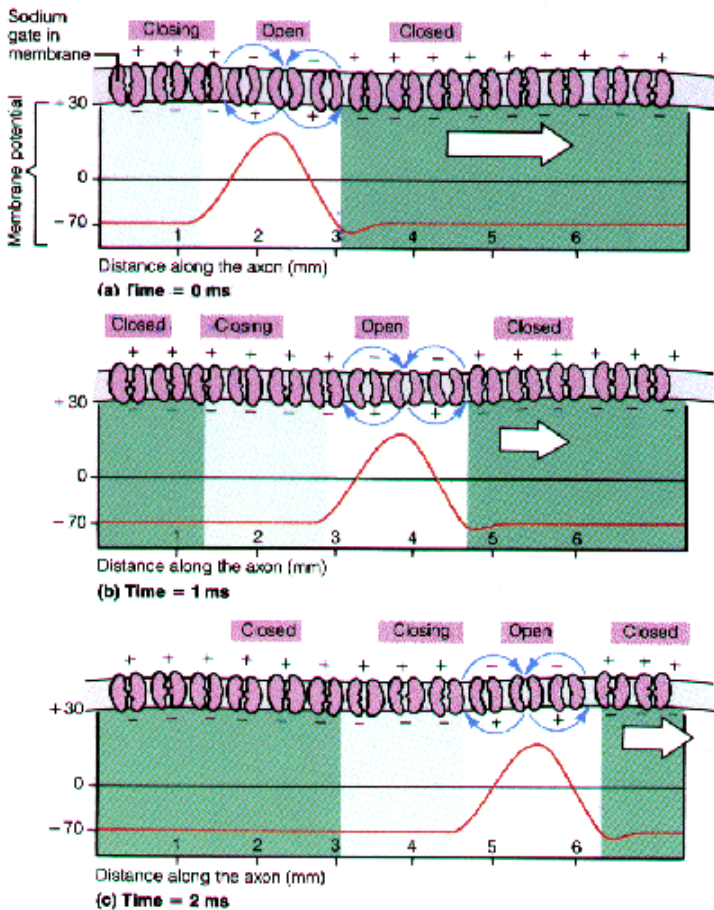
- Resting neurons maintain a difference in electrical charge across their cell membranes
- The inside of the resting neuron is negatively charged, the outside is positively charged
- When a neuron is stimulated this polarity is reversed, these reversals are called **action potentials**



ACTION POTENTIAL

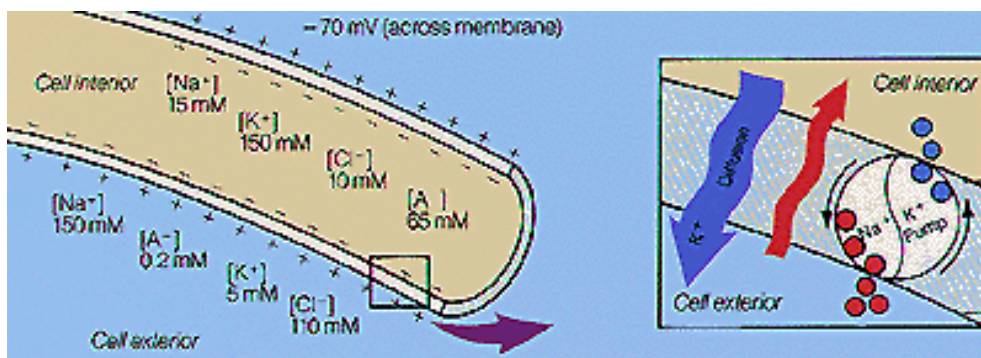
- Nerve impulses are conducted along the neuron by a wave of membrane polarity reversals (action potentials)
- Chemical messengers (neurotransmitters) carry nervous impulses from one neuron to another across the synapse

Propagation of an action potential



THE NEURON MEMBRANE AT REST

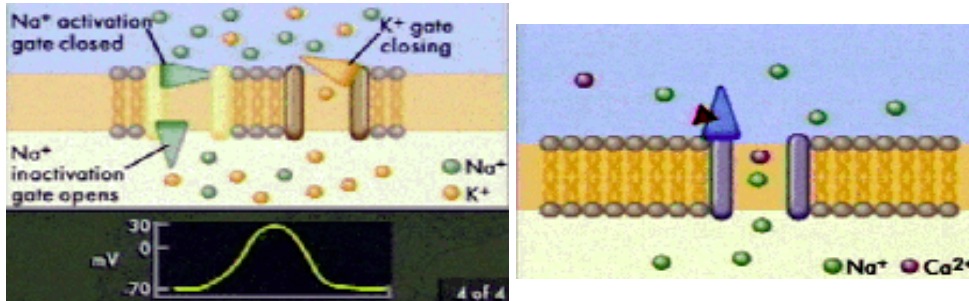
- Neuron maintains a resting membrane potential of about -70 millivolts across the cell membrane
- Sodium(Na+) and potassium(K+) are the main ions involved
- ✓ Na+ and K+ cannot pass through the lipid bilayer membrane
- ✓ move through the membrane by using membrane proteins (pumps)



MEMBRANE PROTEINS

➤ **Membrane proteins do several things:**

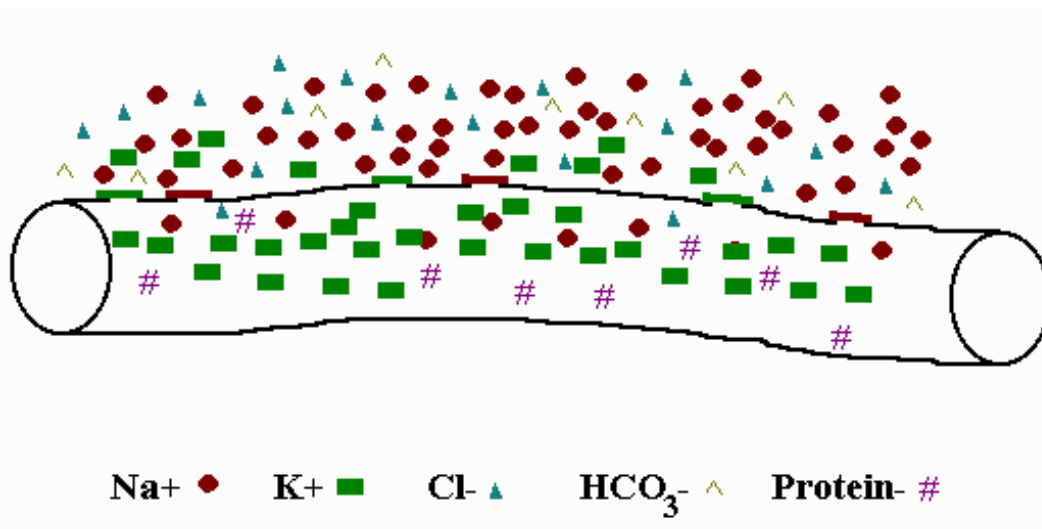
- ✓ Some "leak" ions all the time
- ✓ Some "leak" ions only when the cell has been stimulated (ion "gates")
- ✓ Some "pump" ions by active transport



Na⁺ / K⁺ PUMP

➤ **Membrane proteins actively transport**

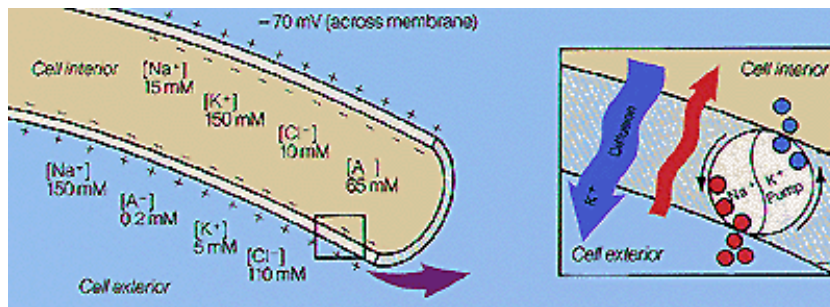
- ✓ sodium out of the cell
- ✓ potassium in
- ✓ Three Na⁺ are pumped out for every two K⁺ pumped in
- ✓ result is the cell has more Na⁺ on the outside and more K⁺ on the inside



Na⁺ / K⁺ PUMP

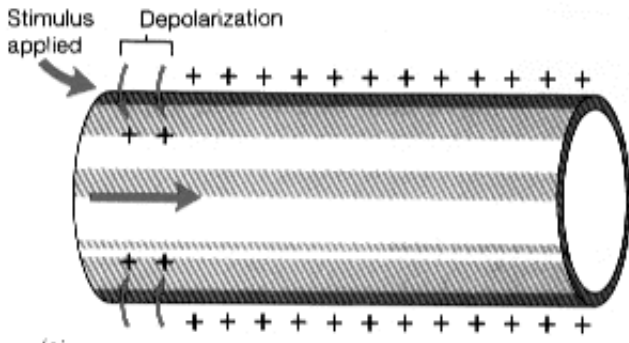
➤ **The pumping of Na⁺ out makes the outside more positive and the inside of**

the cell more negative

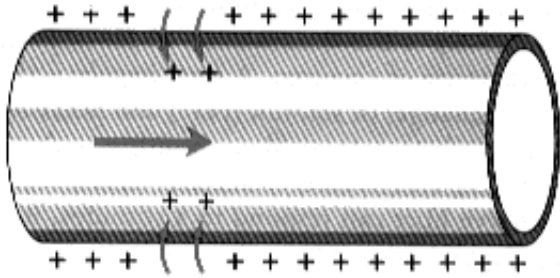


STIMULATED NEURON

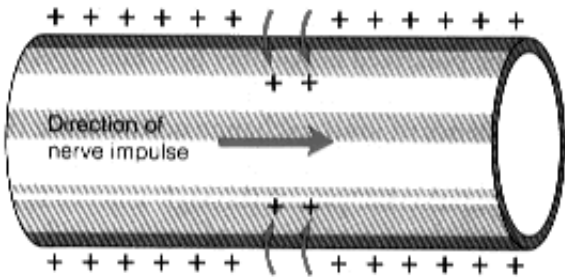
- Nerve cells are unique in their ability to carry a signal using membrane potential changes
- Stimulation of a neuron opens some of the membrane proteins (a.k.a. Na^+ gates)
 - ✓ allows Na^+ to pass freely into the cells
- free flow of Na^+ into the cell causes a reversal of membrane polarity
 - ✓ polarity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



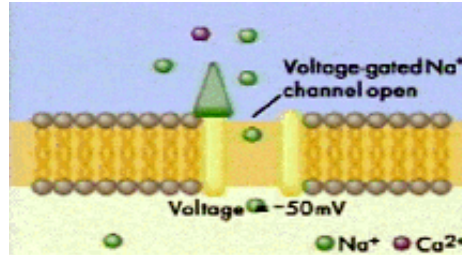
(a)



(b)

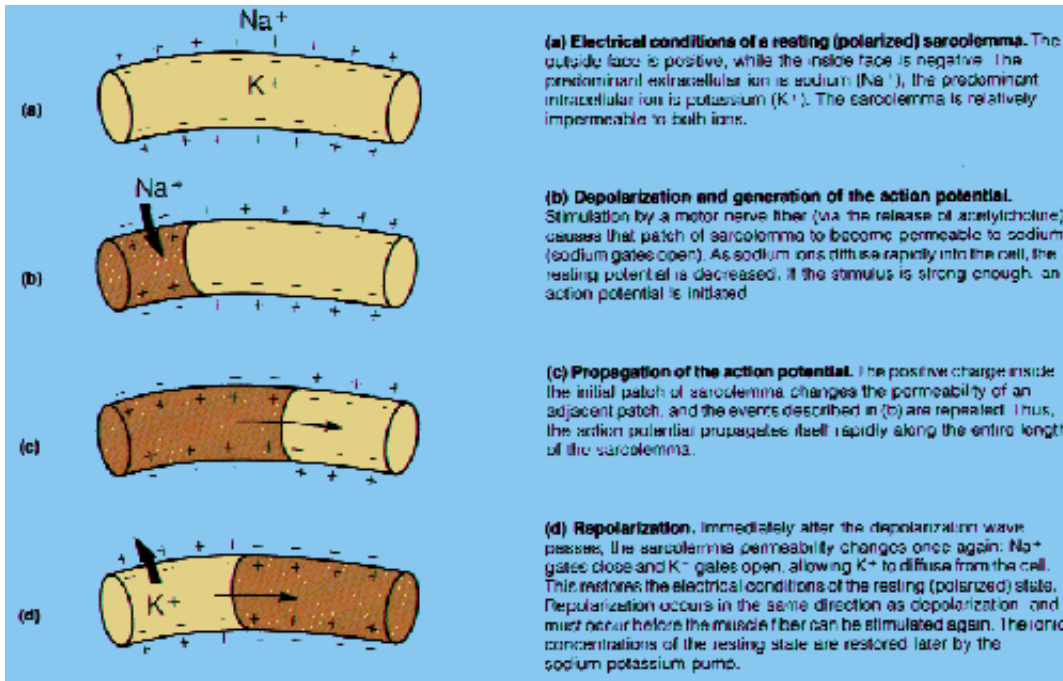


(c)



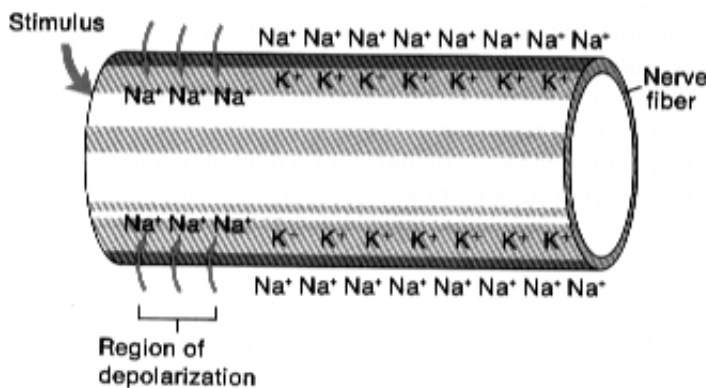
ACTION POTENTIAL

- 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

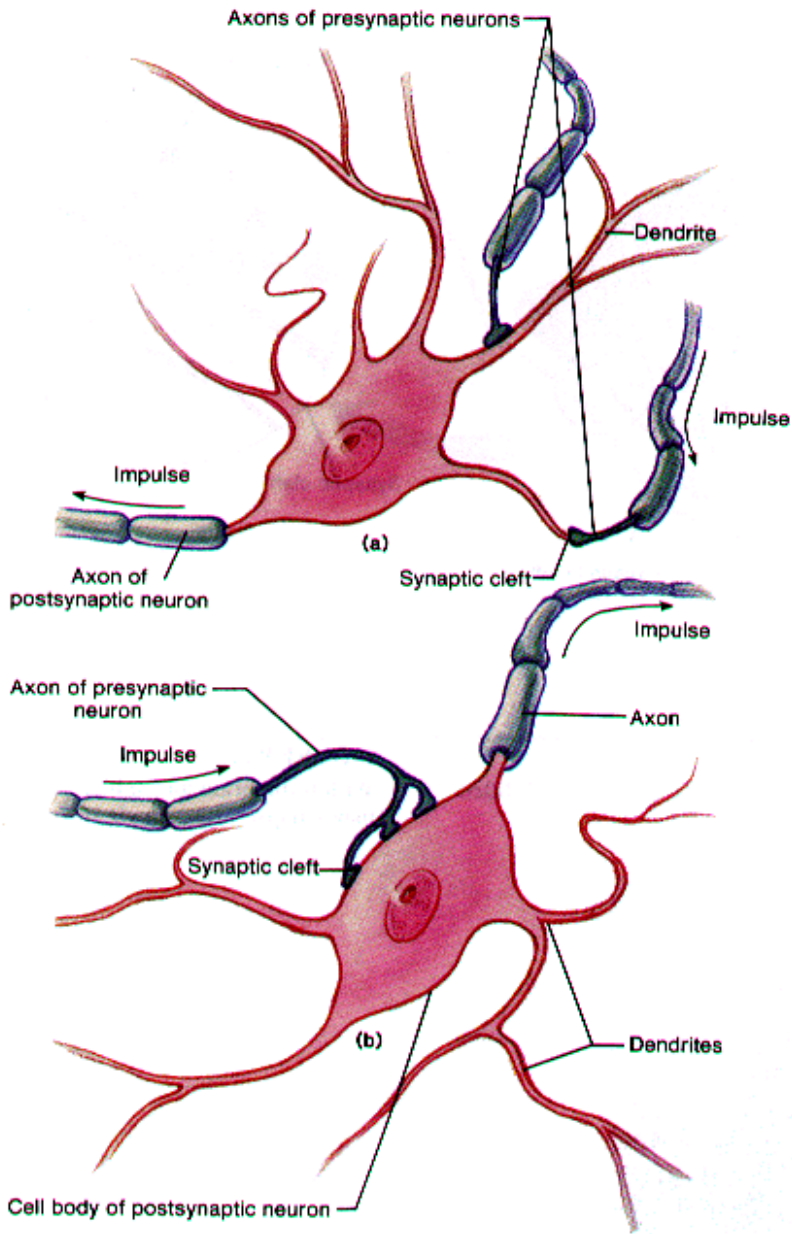


ALL-OR-NONE RESPONSE

- 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

