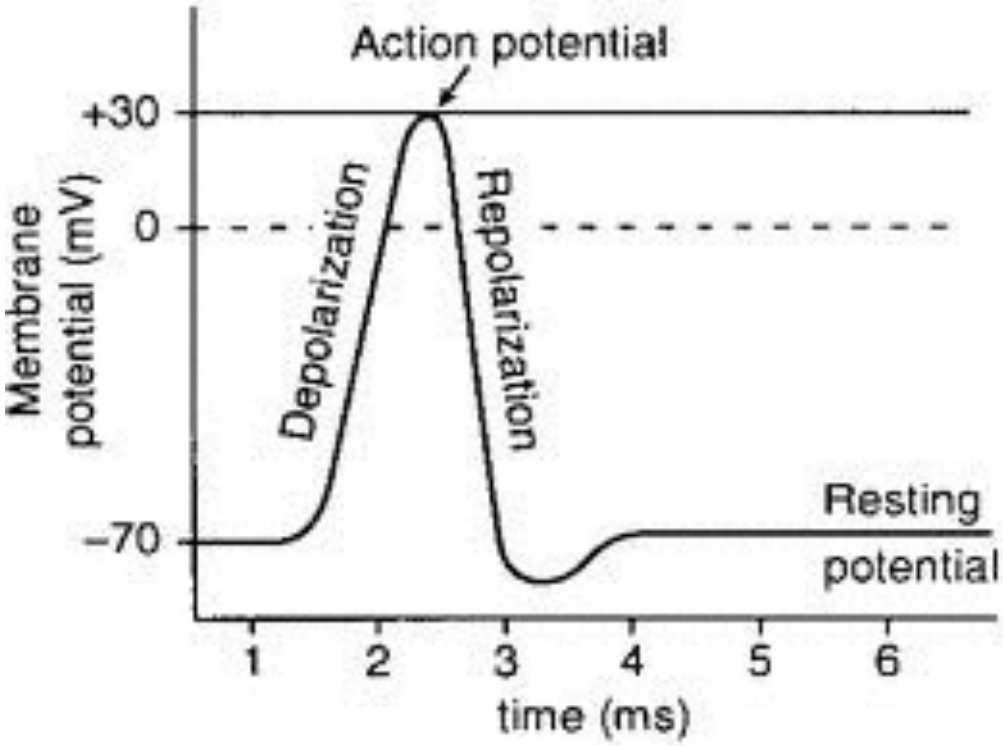
Ch. 11: Fundamentals of the Nervous System

Part 2

Action Potentials

- Brief reversal of membrane potential (-70 to 30mv)
- 3 phases
- Do not decay with distance
- Lasts about 3 ms
- Also called a nerve impulse



Generation of an AP

- 1.) Resting State: All gated Na+ and K+ channels are closed.

Generation of an AP

- 2.) Depolarization: Na+ channels open

Generation of an AP

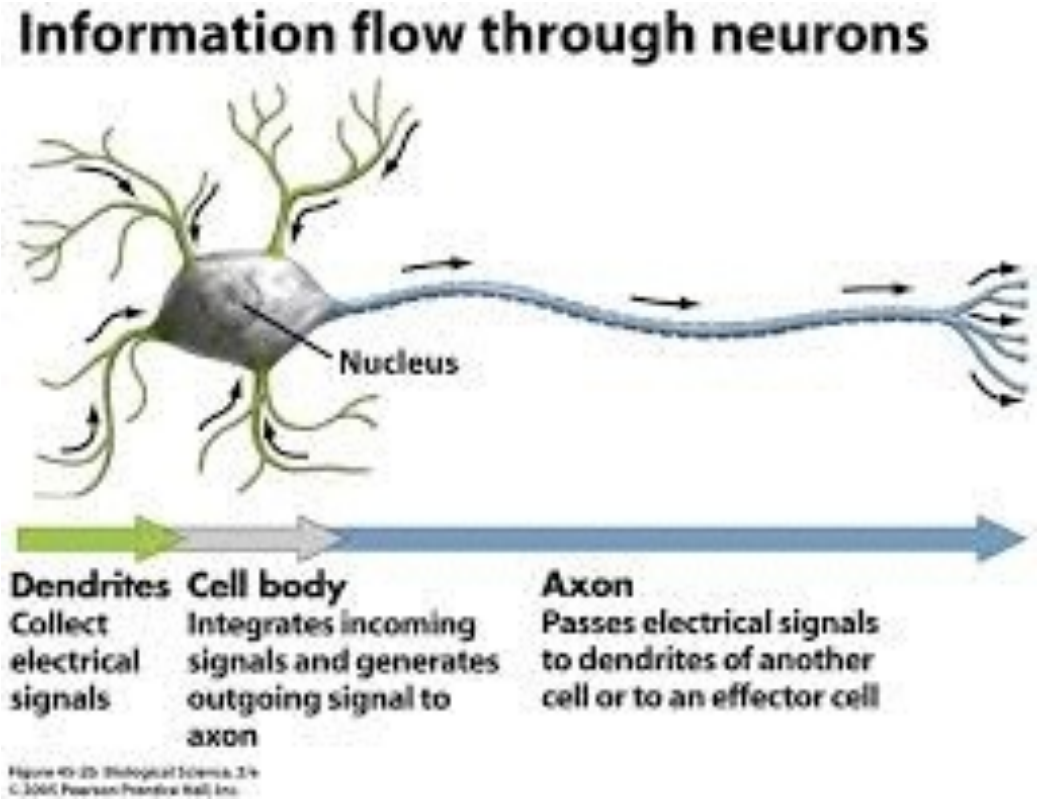
- 3.)Repolarization: Na+ channels are inactivating, and K+ channels open

Generation of an AP

- 4.) Hyperpolarization: Some K+ channels remain open, and Na+ channels reset.

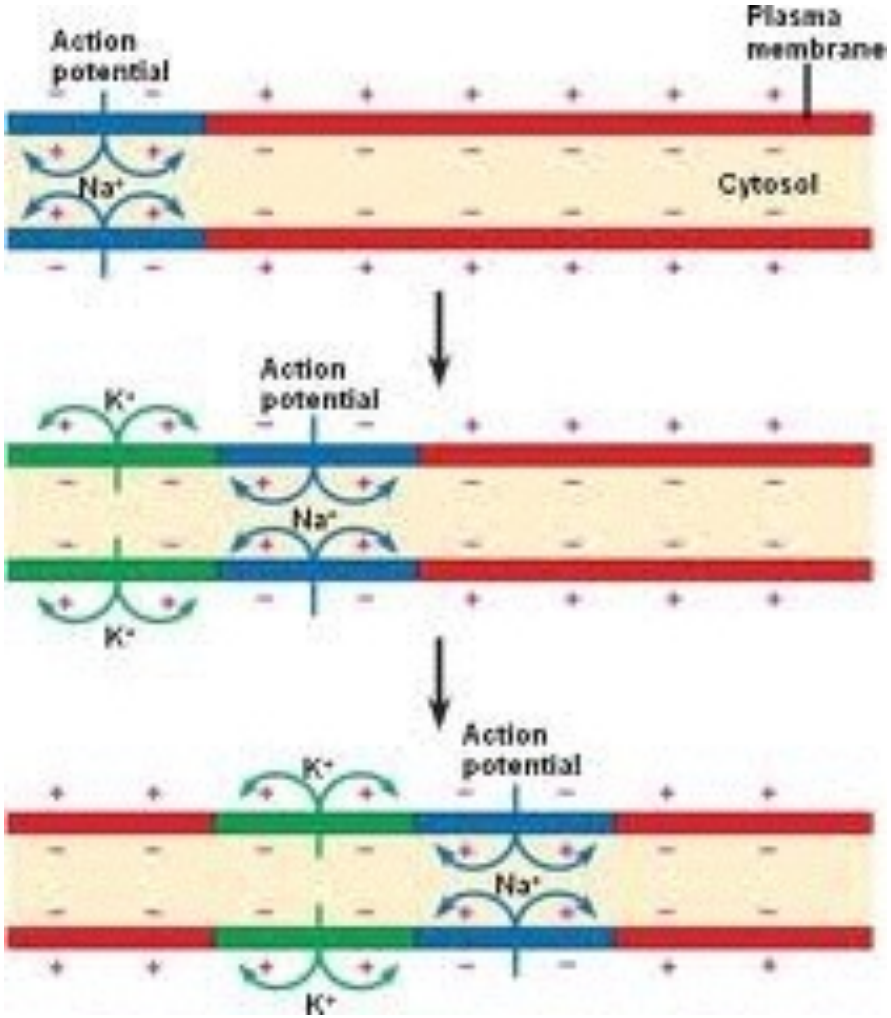
Threshold and the all or none phenomenon

- threshold must be reached in order to generate an AP
- 15 to 20 mv membrane depolarization
- subthreshold vs. threshold stimuli
- all or none phenomenon
- match analogy



Propagation of an AP

- Propagation of an action potential fig 11.12
- Coding for Stimulus Intensity
- Refractory Periods
  - Absolute Refractory Period
  - Relative Refractory Period



Propagation of an AP

- Conduction Velocity
  - Axon Diameter
  - Degree of Myelination
    - Continuous versus Saltatory Conduction

Figure 11.15

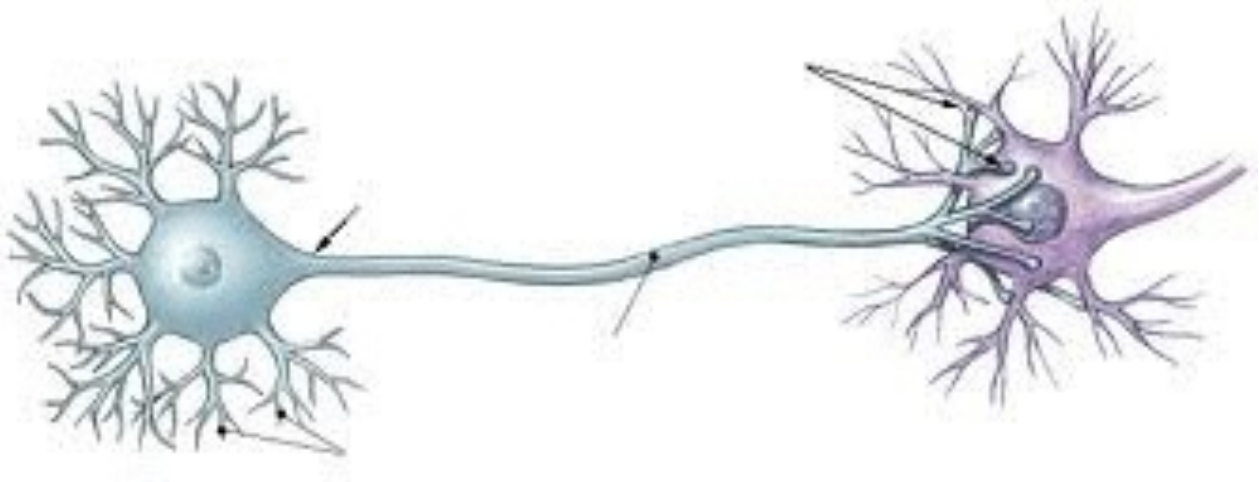
Propagation of an AP

- Group A fibers
- Group B fibers
- Group C fibers

The Synapse

- Two types
  - axodendritic synapses
  - axosomatic synapses

- Two neurons
  - presynaptic neuron
  - postsynaptic neuron

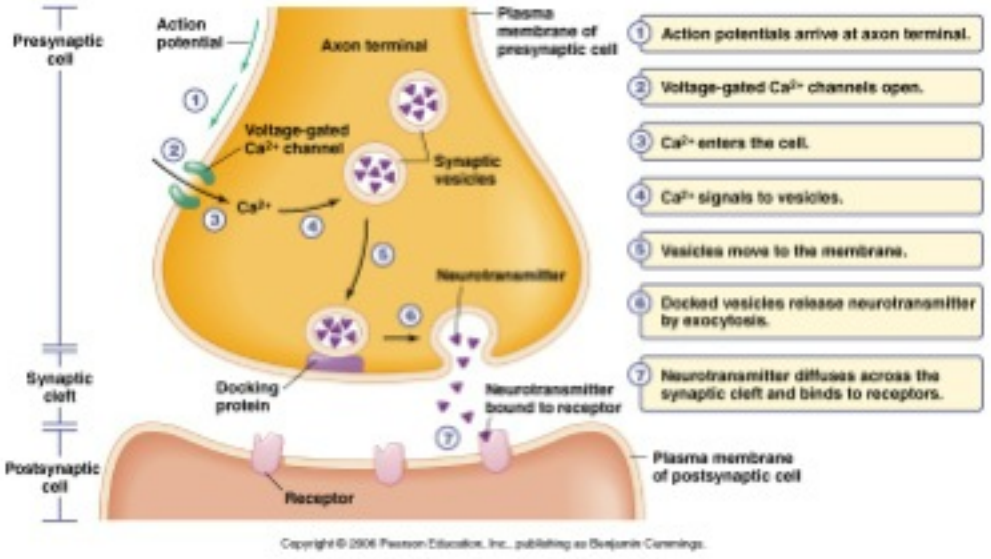


The Synapse

- Electrical Synapse
- Chemical Synapse

Information Transfer Across Chemical Synapses

- 1. Action Potential arrives at axon terminal
- 2. Voltage Gated Ca2+ channels open and CA2+ enters the axon terminal
- 3. Ca2+ entry causes synaptic vesicles to release neurotransmitter
- 4. Neurotransmitter diffuses across synaptic cleft and binds to postsynaptic receptors
- 5. Binding of neurotransmitter opens ion channels, creating graded potentials
- 6. Neurotransmitter effects are terminated



Postsynaptic Potentials and Synaptic Integration

- Excitatory Synapses and EPSP's
- Inhibitory Synapses and IPSP's
- Integration and Modification of synaptic Events
  - Temporal Summation
  - Spatial Summation
- Synaptic Potentiation
- Presynaptic Inhibition

Neurotransmitters

- Classification of Neurotransmitters by chemical structure
  - Acetylcholine
  - Biogenic Amines
  - Amino Acids
  - Peptides
  - Purines
  - Gases and Lipids
  - Gasotransmitters
  - Endocannabinoids

Neurotransmitters

- Classification of neurotransmitters by function.
  - Effects: Excitatory Vs. Inhibitory
  - Actions: Direct Versus Indirect

Neurotransmitter Receptors

- Channel-Linked Receptors: Mechanism of Action
- G Protein-Linked Receptors: Mechanism of Action

Basic Concepts of Neural Integration

- Organization of Neurons: Neuronal Pools 11.22
- Types of Circuits Fig 11.23
- Patterns of Neural Processing
  - Serial Processing
  - Parallel Processing

Study Guide