**Action Potentials**

**Action Potentials [1-2 millisecond]**

* **Voltage dependent ion channels in neurons**
  + Are activated/inactivated by only voltage change specific for only 1 ion.
  + Ball (tertiary structure) and Chain (linear amino acid) proteins
    - At resting membrane potential: the voltage gated ion channels are closed. Channels open via voltage change, diffusion directs direction of the ion. The channel are inactivated via voltage change as the amino acid chain swings the protein ball onto the voltage gated ion channel.
* **Functional/Structural Neurons**
  + ***Dendrites***- receive signals
  + ***Axon***- transmit signals
  + ***Synapse***- area that affects another cell [another neuron or muscle cell]
* **Threshold Voltage**
  + If -55 mV the Na+ channels open: membrane becomes more positive [depolarization]. At +30 mV the Na+ channel closes and the K+ channels open and the cell then hyperpolarizes. At -75 mV the K+ channel closes. The Na+/K+ ATP pump then brings the cell back to the -70 mV resting membrane condition.
* **All-or-nothing law**
  + Either the action-potential happens or nothing. All action-potentials are the same size (same amplitude to all)

* **Refractory Periods**- period of time when it is harder or impossible to get another action-potential in a neuron
  + **Absolute Refractory Period**- impossible to get another action-potential in the neuron because the Na+ channels are already open
    - Also, cannot get another action-potential because the Na+ channels are inactivated by voltage
  + **Relative Refractory Period**- take a larger stimulus to get another action-potential -75 mV to -55 mV

**Factors Affecting Action Potentials**

* ***Hyper/hypokalemia***
  + **Hyperkalemia** is the excess of K+ ions in the plasma membrane. The kidneys are not able to excrete the ions and can cause cardiac arrhythmia [neurons regulate the heart rate]and muscle weakness (motor neurons- innervate skeletal muscles)
  + **Hypokalemia**- low K+ in the blood plasma. If a patient is on a diuretic [urination], it is to lower the high blood pressure. Can lose K+ ions to the urination. Can cause heart problems and convulsions.

* ***Drugs***- [-aine]- lidocaine, novacaine, cocaine. Quieting pain neurons. Cause blockage of voltage gated Na+ channels
* ***Toxins***- affect the channels in action potentials
  + Puffer fish- blocks sodium channels
  + Arrow Dart- keep sodium channels open.

* ***Heredity***- have genetic abnormality in sodium and potassium channels