objectives

- RESTING MEMBRANE POTENTIAL (RMP)
- ELECTROCHEMICAL EQUILIBRIUM
- GIBBS - DONNAN POTENTIAL
- NERNST EQUATION (ION EQUILIBRIUM POTENTIAL)

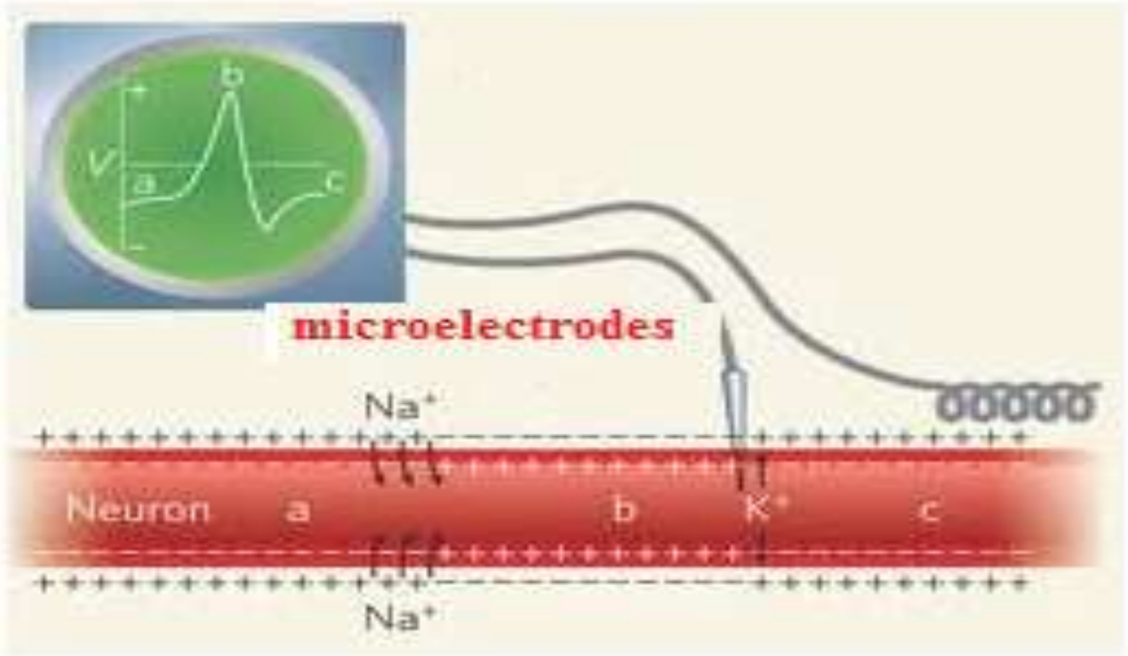
Excitable membrane tissue

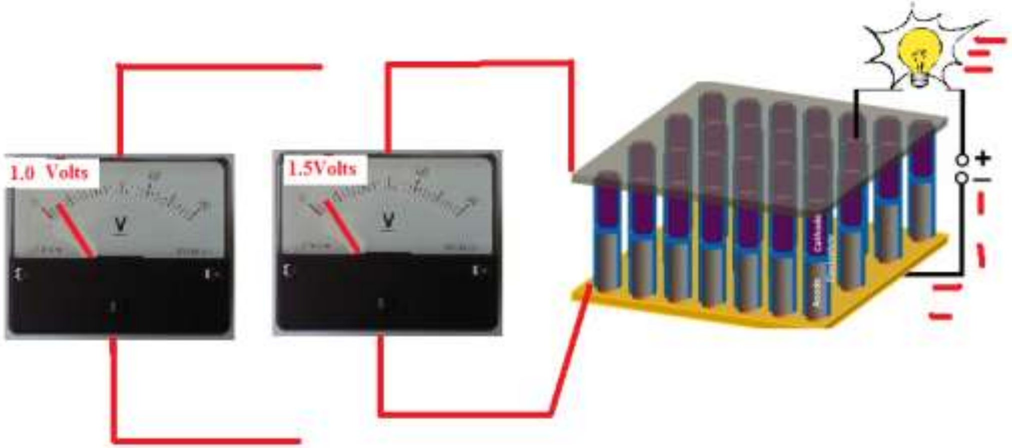
neurons or nerves are identified as excitable cells because they can be electrically excited resulting in the generation of action potentials. Other examples of excitable cells are skeletal, smooth, and cardiac muscle cells

Membrane potential

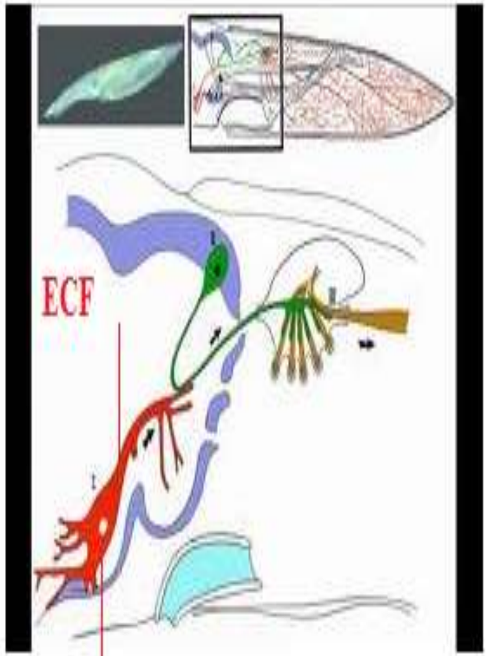
- Biological function and one of the examples is

  Action potential
- Muscle contraction
- Signal transduction





hodgkin and huxley



ICF

-70mV resting membrane
-90mV potential (RMP)

Constant in all cells except in Muscle and Nerve (Excitable Cells)

1.5 V 1000mV= 1V
70 mV into 100 mV 0.1V * 60 trillions.

EMG , EEG, ECG

Resting membrane potential

K outflow is important than Na+ inflow

Nernst equation

equilibrium potential = conc outside/ conc inside

equilibrium potential= - log conc inside/ conc outside

Goldmans equation

Selective permeability 95%

Na+ and K+ ATP ase Pump

Application

Hypokalemia sodium CNS

K+ cardiac

- Decrease K+
- Increase K+ efflux
- Decrease Depolarization

Hyperkalemia

Increase K

Decrease K+ efflux

Increase depolarization cardia arrest

Myelinated versus non myelinated

How fast is the action potential in our living cells? Let us compare electrical conduction in a wire which is about 186000miles/sec and in the action potential is 100m/sec in thickest myelinated nerve cell ; in the wire it is electrons moving through a copper wire while in the cells it is moving through cytoplasm thus it is not even comparable

Myelinated

- Special types of cells called glial cells : macroglia;

Oligodendrocytes; if it in the CNS

Shawn cells ; and if it is around sensory and motor cells in peripheral CNS

The largest area and the short length the faster is the velocity

A>B>C

C Most affected by lidocaine (local anesthesia)

A hypoxic metabolic active and away from blood supply

- Neurons and neuroglial cell (non excitable)

- Axon Hillok

Depolarization : Na+

Hyperpolarization: Cl-

Repolarization: K+

Anti arrythmia Na+ channel blockers (local anesthetic)

Sedative and hypnotics influx of Cl- the frequency ions

K+ influx inner ear

general anesthesia GABA

donna's equilibrium

- The presence non diffusible ions on one side of the membrane affects the distribution of diffusible ions on both sides of a semipermeable membrane.

At equilibrium

Protein component	non protein component
9 protein -	6Cl-
3 CL-	6Na+
12Na+	

Results of donna's equilibrium

Protein component (blood)   Non protein component (cells)

- Conc of Na^+ = Electrical of Na^+
- Positive charge= -negative charge in each compartment
- The product of Na^+ and Cl^-= Product of Na^+ and Cl^-
- The sum of Na^+ and cl^-> The sum of Na^+ and cl^-
- Osmotic pressure >
- water moves from non protein to protein

Physiology versus pathology

Hypoperfusion

Heart: Angina

Brain: ischemic stroke

Liver: cholecystitis

Shock

Factors affecting perfusion (Effective arterial blood Volume)

Oncotic pressure

Donna's equilibrium

Plasma Proteins are acting in their own self interest