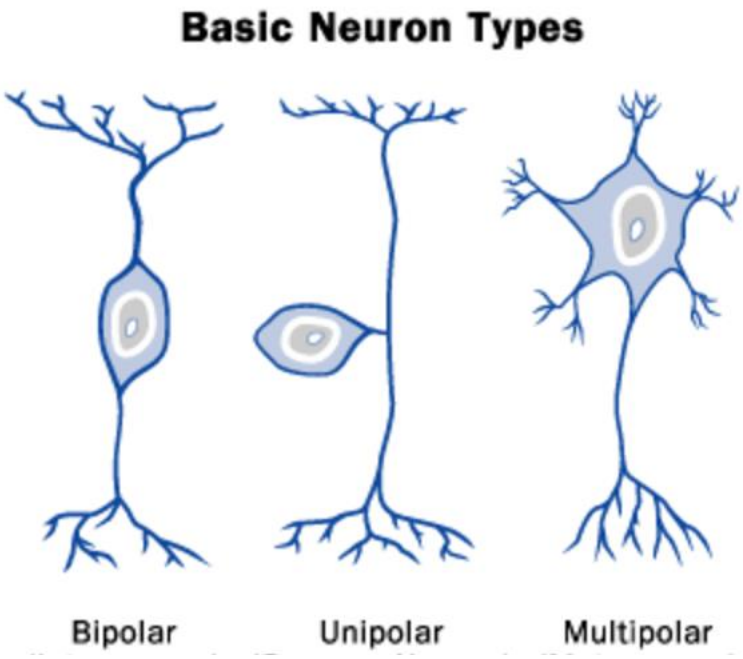
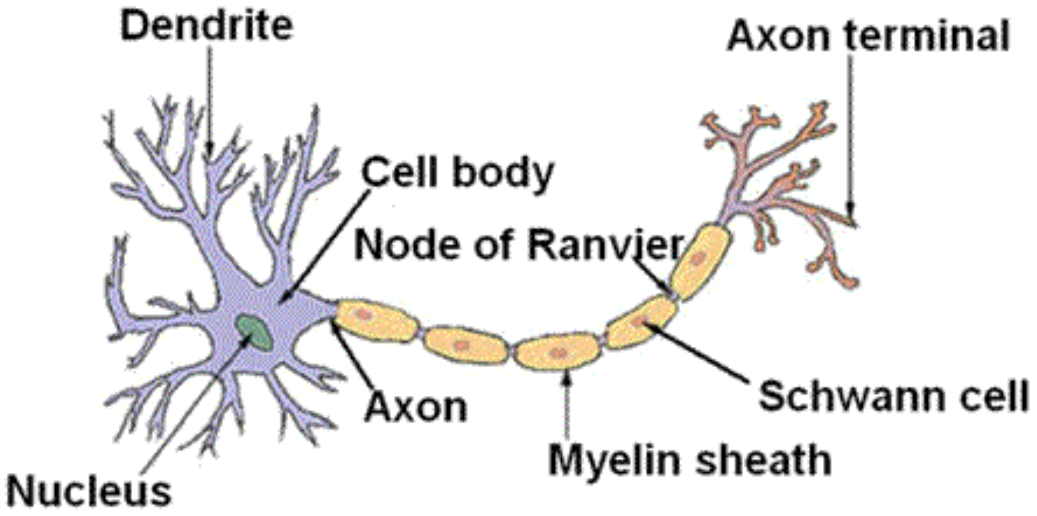
Julianna
Biopsychology (PSY 302)
The Neurons
Class 1
08/24/17

- Functional Classes: Central Nervous System+ Peripheral Nervous System
  - Sensory neurons (collect internal and external information)
  - Motor neurons (control muscles)
  - Other ('interneurons')
- Morphology
  - Neurons fall into several morphological classes (shapes)
  - The Study of neuron *shapes* is called "Neuro-anatomy"
  - In some cases, the shape of a neuron is indicative of its function
- 3 Basic Shapes (How many branches are <u>coming out</u> of the cell body?)
  - Unipolar Neuron (1 branch)
  - Bipolar Neuron (2 branches)
  - Multipolar Neuron (many branches)

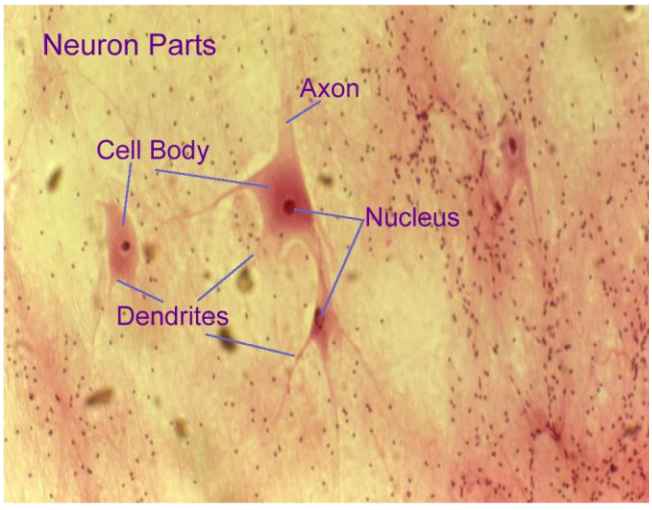


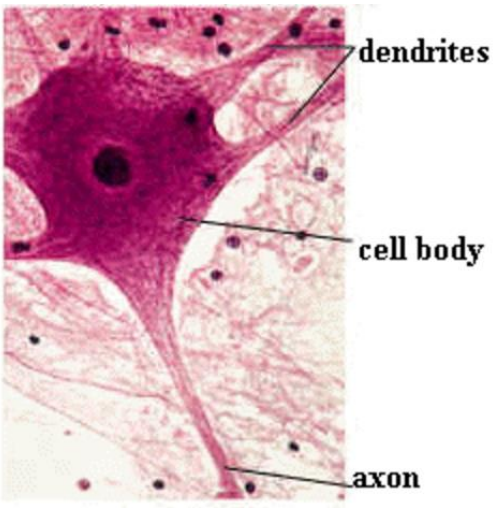
- Multipolar Neuron
  - Soma (cell body)
  - Dendrites (branches coming out of cell body)
    - Input of information
  - Axon (inside myelin sheath)
    - Output of information
  - Myelin Sheath
  - Terminal Boutons

- Neurotransmitter (chemical)
- Information is 'summed' at the soma, from all the dendrites. It is then sent away on the axon.
- Flow of Information: Spines, dendrites, soma, axon, terminal boutons, neurotransmitter



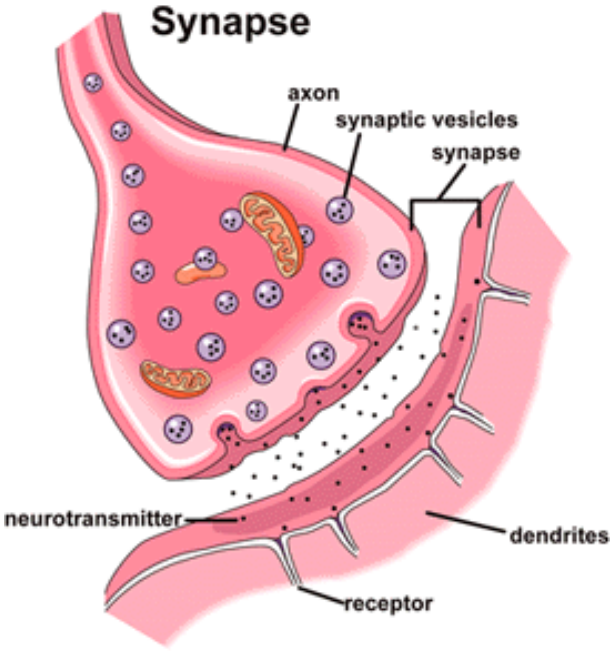
- Bipolar and Unipolar
  - Example of Bipolar: retina (vision) and cochlear nerve (audition)
  - Example of unipolar: spinal cord (touch)
  - Sensory Neurons: External or internal stimuli→ brain
  - Motor Neuron: Brain → muscles, glands
- Neuroanatomy: The real thing!



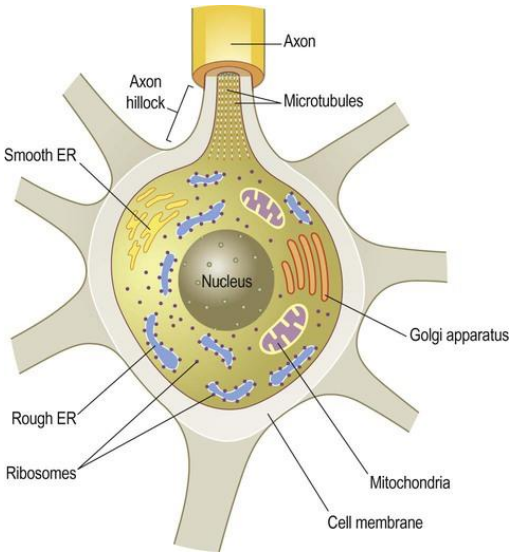


- Nerve= bundles of axons
  - Axons and Nerves are covered with myelin sheath

- Synapses
    - Neurons 'talk' to each other through synapses
    - Presynaptic ('Pre'= before)
    - Postsynaptic ('Post'= after)
    - The synapse is a 'place'… not an 'object'

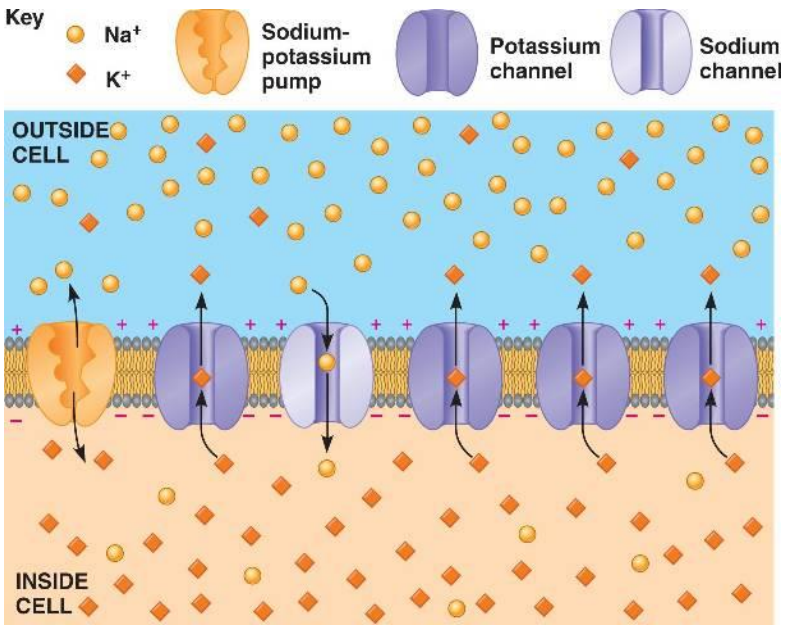


- Inside a Multipurpose Neuron:
    - Mitochondria
        - Energy, ATP (*Symbiosis*)
    - Nucleous
        - Chromosomes, DNA, genes, proteins, enzymes
    - Cytoskeleton: ensemble of microtubules and other proteins that together produce the shape of the neuron
    - Microtubules
        - Axoplasmic transport
    - Myelin sheath
    - Cytoplasm
    - Membrane (lipid bilayer)

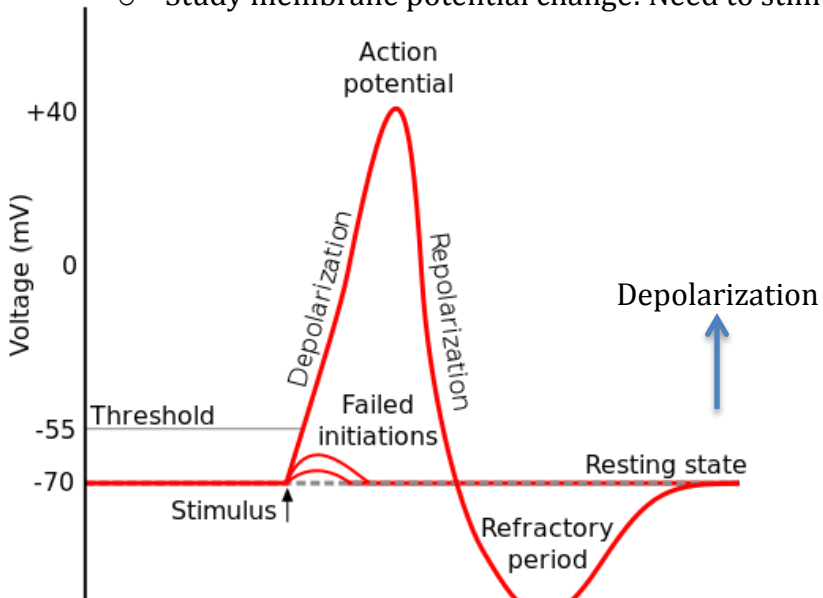


- The neurons
    - Neurons support many functions: Perception, action, thinking, emotions
    - Neurons need to be "taken care of" throughout the nervous system
        - Glial (glue) cells
    - 3 types of Glial cells:
        - Astrocytes
        - Oligodendrocytes
        - Microglia
- Astrocytes: 'star' cells ('city workers')
    - Buffers for chemical substances
    - Structural support
    - Cleanup (phagocytosis)
    - Nourishment (ex: lactate)
    - Active interface between blood vessels and neurons
- Oligodendrocytes: myelination
    - Destroyed in Multiple Sclerosis Patients
    - Schwann cell (PNS)
    - Oligodendroglia (CNS)
    - Nodes of Ranvier
        - Gaps in the myelin sheath of a nerve, between adjacent Schwann cell.
        - Ion flow across the membrane occurs only at the nodes of Ranvier
- Microglia
    - Smallest of glial cells
    - Phagocytes (motile)
    - Members of the immune system un the brain (like macrophages in the blood)
    - Are activated during inflammatory reaction due to brain damage (Alzheimer's)
- Blood-Brain Barrier
    - Selective permeability
    - Active transport (ex: glucose)
    - Area Postrema in the brain: control of vomiting
- The Neurons
    - NeuroAnatomy: How the neurons "look"
    - NeuroPhysiology: How the neurons "work"
    - Neurons are electrical devices
    - Electrons vs. Ions
        - Electrons: 'free floating' information (un-usable)
        - Ion= Atom molecule+ electrons: 'channeled information'
- Inside vs. Outside

    - Differences of electrical potential between the 'inside' of a neuron (cytoplasm), and the 'outside' (extracellular space)
    - Resting membrane potential (~70mV)
- The resting membrane potential
    - 2 Force:
        - Diffusion: from high concentration to low concentration
        - Electrostatic pressure: same charges repel
    - Extracellular (outside of cell)
    - Intracellular (inside of cell)



- Keep the Sodium Out!
    - Sodium-Potassium pump (a.k.a. transporter)
    - Keeps sodium out, potassium in
- Membrane Potential: departure from rest
    - Hyperpolarization: Membrane potential goes more negative
    - Depolarization: membrane potential goes more positive
- Action Potential
    - Study membrane potential change: Need to stimulate



- Voltage-Dependent Ion Channels
  - Fact 1: Ions move in/out of the cell through ion channels
  - Fact 2: Ion channels open when the membrane depolarizes enough
- Ion Flow During an A.P.
  - Fact 3: K^+ channels are a bit slower than the NA+ channels
  - Na^+ in→ Depolarizes
  - K^+ out→ Hyperpolarizes

Hyperpolarization