Neurors

- Functional Classes: Central nervous system (NS) + Peripheral NS
  - Sensory neurons (collect internal and external information)
  - Motor neurons (control muscles)
  - Other (interneurons)

- Morphology (what it looks like)
  - 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 coming out of cell body
    - Unipolar neurons, Bipolar neurons
      - Sensory neurons: External or internal stimuli -> brain
      - Motor neurons: Brain -> muscles, glands

- Multipolar neurons
  - Information is “summed” at the soma, from all the dendrites. It is then sent away on the axon
• Nerve = bundles of axons

• Synapses
  o Neurons ‘talk’ to each other through synapses
  o The synapse is a ‘place’ not an ‘object’
  o Circuit diagram

• Inside a multipolar neuron
  o Cytoskeleton: ensemble of microtubules and other proteins that together produce the shape of the neuron

• The neurons
  o Neurons support many functions: Perception, action, thinking, emotion...
  o Neurons need to be ‘taken care of’ throughout the nervous system
  o NeuroAtatomy: how the neurons ‘look’
  o NeuroPhysiology: How the neurons ‘work’
○ Neurons are electrical devices

● The Glial cells: 5 times more than neurons
  ○ 3 basic types
    ■ Astrocytes
      ● ‘City workers’
      ● Buffers for chemical substances
      ● Structural support
      ● Cleanup (phagocytosis)
      ● Nourishment: e.g. lactate
      ● Active interface between blood vessels and neurons
    ■ Oligodendrocytes (CNS): Myelination
      ● These are destroyed in MS Patients (Multiple Sclerosis)
    ■ Schwann cells (PNS)
    ● Microglia
      ● Smallest of glial cells
      ● Phagocytes (motile)
- Members of the immune system, in the brain (like macrophages in the blood).
- Are activated during inflammatory reactions due to brain damage (alzheimer’s)

- **Blood-Brain Barrier**
  - Neurons need to be protected from blood
  - Selective permeability
  - Active transport (e.g. glucose)
  - Exception: Area Postrema in the brain: control of vomiting

- **Inside vs Outside**
  - Difference of electrical potential between the ‘inside’ of a neuron (cytoplasm) and the ‘outside’ (extracellular space)
  - Has energy at rest

- **The resting membrane potential**
  - 2 forces
    - Diffusion: from high concentration... to low concentration
    - Electrostatic pressure: same charges repel

- **Keeping sodium out**
  - sodium-potassium pump (a.k.a. transporter)
  - Keeps sodium out, gets 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
  ■ Stimulator: deliver precise stimulation

- Voltage dependent Ion channels
  ○ Ions move in/out of the cell through ion channels
  ○ Ion channels open when the membrane depolarizes enough
  ○ K+ channels are a bit slower than the Na+ channels
  ○ Na+ in -> depolarize
  ○ K+ out -> hyperpolarize