

**AP Biology**  
**Nervous Systems – Part 1**

(Associated Learning Objectives: 1.15, 1.16, 2.21, 3.43, 3.44, 3.46, 3.47, 3.48, 3.50)

**Important** concepts from previous units:

- 1) The parts to the Signal Transduction Pathway – Reception, Transduction, Response.
- 2) **Ligand** is a term referring to a signal molecule.
- 3) Energy can be in the form of charged particles, called **ions**.

I. The evolution of a Nervous System in animals:

- A. Starts with the evolution of an organism *wide Nerve Net* in Cnidarians (Jellyfish) to help “control” movement.
- B. Evolution of a brain (a mass of neurons) leads to *greater control* of the system. It utilizes a nerve cord to *span* the body.
- C. The evolution of other sensory organs in the *head region*, called **Cephalization**, allows for reception and response to *various types* of stimuli from the environment.

II. Overview of the Nervous System:

- A. **Sensory Input** - Sending information *into* the brain or spinal cord neurons in the body.
  1. Sensory Receptors *receive* a stimulus from the environment. A **stimulus** is a *form of energy* such as electromagnetic (light), mechanical (pressure), or sound waves.
- B. **Integration**
  1. This is the *interpretation* of the energy by the **Central Nervous System (CNS)**. (Basically “thinking” about the stimulus.)
  2. This interpretation of the stimulus leads to a *determination of the appropriate response*.
- C. **Motor Output** – Sending *out* of impulses from the brain or spinal cord to glands or muscles to “create” a *response*.
  1. The response is carried out by **Effector Cells**.
    - a. Effectors are Muscles or Glands. These structures can have an *effect* on your body.
- D. **Peripheral Nervous System (PNS)**
  1. This includes the Sensory receptors and Motor Nerves.

IV. **Neuron** (Nerve cell) structure :

- A. **Cell Body** - This takes stimuli from *different* dendrites and *compiles the energy* into one signal, like a funnel for fluids.
- B. **Dendrites** - These collect and carry stimulus energy **IN** to the cell body. They cover a *large area*.
- C. **Axon** - This *one* arm carries the one compiled signal **AWAY** *toward the next* neuron or effector cell.
  1. **Axon Hillock** - This is the swelling around the connection between the cell body and the axon.
- D. **Myelin Sheath** - This is a lipid layer of *insulation* around the axon created by **Schwann Cells**. It *prevents* the electrical energy of the neuron from burning the overlying muscle tissue. It is analogous to the rubber covering on electrical wires.
- E. **Synaptic Terminal** - At the end of the axon. (“terminal” means “end”)
- F. **Synapse** - This is the *gap* between neurons or between a neuron and an effector cell.
  1. **Neurotransmitter** - This is the chemical, produced by the **neuron**, used to *transmit* the signal *across* the gap.
    - a. The most common neurotransmitter is **Acetylcholine**.
  2. The neurotransmitter is released from the **Presynaptic cell**. (A neuron)
  3. The neurotransmitter travels to the **Postsynaptic cell**. (A neuron or effector cell.)

V. **Ganglia** - This term refers to a bundle of neurons in the PNS.

VI. **Nuclei** – This term refers to a bundle of neurons in the CNS. The “brain” is a collection of nuclei

VII. Types of accessory (helping) cells:

- A. **Glial Cells** - These are *supporting* cells for neurons to “hang’ onto. They are analogous to the frame for a house.
  1. They help to maintain the integrity (functioning) of system.
- B. **Oligodendrocytes** - This term refers to the **Schwann cells** of the **CNS**. Same *type* of cells; just in a *different* location.  
**Schwann Cells** - This term refers to the insulating cells in the **PNS**.
  1. Each acts as insulation around an Axon.
  2. These cells produce **Myelin** - a “Lipid” based substance that is a poor conductor of electricity.
  3. **Multiple Sclerosis (MS)** – This disease is where the Schwann cells in the CNS and PNS begin to die. The electricity traveling through the nerves then burns the muscles into permanent painful contractions until death.