

NERVOUS SYSTEM

- a **network of nerves** that *connect the spinal cord and the brain to the rest of the body and allow a stimulus--response reaction to occur among different organs*

- has *numerous functions* in the human body, since *nerves begin at the brain and connect to different organs they serve as a control system that dictates all voluntary and involuntary actions performed by the body*

Neurons

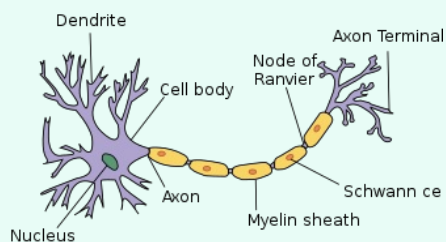
- **nerve cells** called *neurons* carry out the *main functions* of the *nervous system*

Neurons - the *fundamental units* of the *nervous system*

- these are *cells* that *translate external stimuli* into **electrical signals** *transmitted into the brain* where the delivered information is *interpreted*

- the *nervous system* contains billions of neurons that are made up of *three main sections*

Neurons



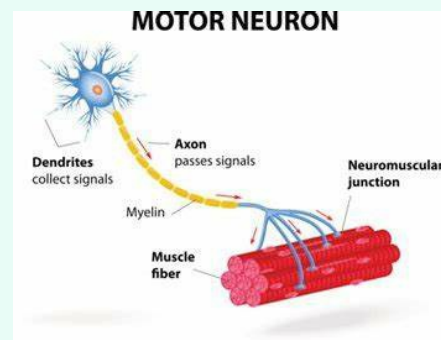
Three Main Sections of Neurons

Cell Body / Soma - the **main part of the neuron** where the *nucleus* is located^[1] - translates *DNA information* that is transported to the *dendrites* and the *axon*^[2]

Axon - the **thick branch** that **trails behind the soma**^[1] - the **axon terminal** at the end of the axon allows *communication* among *various neurons*^[2] - the axon is surrounded by the **myelin sheath** (a *protecting covering* that insulates the axon and lets **electrical impulses** travel *more quickly* along the unmyelinated axon, the impulses are transmitted through a process called **action potential**^[3]

Dendrites - **smaller branch-like extensions** attached to the ends of the soma^[1] - dendrites *process electrical impulses before transmitting them to the axon through the action potential*^[2] - the *information received by dendrites* may be either **excitatory** (*fires up neurons*) or **inhibitory** (*represses the neurons' tendency to fire up*)^[3] - the *dendrites of one neuron connects with the dendrites of other neurons*^[4] - they can *change sizes* as they *receive information* and the *transmission of signals from a neuron of tissues of various body organs is exhibited*^[5] - **this process works through the three types of neurons** distributed throughout the body; then these signals are passed on by the axon; after the brain interprets the signals. *interneurons in the spinal cord receive the information and transmit it to motor neurons in various body organs*

Transmission of Signals from Neurons to Tissues



Three Neuron Classification

Sensory Neurons - react to *both external and internal stimuli*^[1] - they **pick up information from outside your body** and *deliver* it to your **central nervous system** allowing you to perceive your surroundings through *sight, hearing, smell, taste, and touch*^[2] - the *sensory functions of these neurons* are controlled by a **reflex arc** that *enables involuntary functions in the nervous system through the spinal cord*^[3]

Interneurons - *translate the information* between **sensory neurons** and **motor neurons**^[1] - *integrate the sensory neurons and motor neurons within the spinal cord*^[2]

Motor Neurons - *pick up information* from the **central nervous system** and *transmit* them through *nerves in the rest of the body*^[1] - these neurons mobilize a person and enable physical changes in the body^[2]

Flow of Information through the Nervous System

| | | |
|-----------------------------|------------------|--------------------------|
| STIMULUS → | RECEPTORS → | AFFRENT NEURONS ↓ |
| ↓ PERIPHERAL NERVOUS SYSTEM | ← INTERN- EURONS | ← CENTRAL NERVOUS SYSTEM |
| EFFRENT/MOTOR NEURONS → | EFFECTOR → | RESPONSE |

Central Nervous System

Brain - the **major organ of the nervous system**; *reads information and controls all the functions of the human body with the help of nerves and neurons*

- the brain's exterior structure is made up of a *protective layer* called **meninges** that wraps the **folds (gyri)** and **indentations (sulci)**

- consists of *two hemispheres* subdivided into *three main parts*: the **forebrain**, **midbrain**, and the **hindbrain**

1 : Forebrain

- makes up the *brain's frontal area*

- contains the *largest section* called **cerebrum** which comprises about **85%** of the *entire human brain structure*

- responsible for *sensory perception, thinking, processing information, understanding and speaking languages*

- most information processing takes place within the **cerebral cortex** (*the outer part o cerebrum*) that is categorized into *four cortex lobes* (**frontal, parietal, occipital, and temporal lobes**)

frontal lobe - located at the *forefront of the cerebral structure* divided into the **motor cortex** (*topmost portion that controls the motor functions and voluntary actions of an individual*) and the **prefrontal cortex** (*governs personality traits, cognitive functions, memory, decision-making process, reasoning, and judgement*)

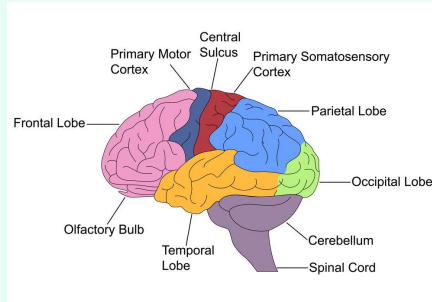
parietal lobe - located *behind the frontal lobe* and contains the **somatosensory cortex** (*processes the sensory information and controls the sense of touch; this also influences the ability of a person to understand spatial orientations and to maintain body coordination*)

occipital lobe - located at the *posterior part of the cerebrum* (*to control visual perception; it allows a person to recognize the physical characteristics of objects that he/she sees; controls the ability to determine the position and the distance of objects*)

temporal lobe - occupies the *position beneath the frontal and parietal lobes* (*auditory perception, speech and memory; also influences partly other sensory perceptions, language comprehensions, and emotional control*)



Forebrain



2 : Midbrain

- lies underneath the forebrain and one of the subdivisions of the **brainstem** (a short tubular structure that connects the brain to the spinal cord)

- to control eyesight and hearing

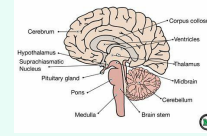
- has three main parts ; the **tectum / colliculi** , the **tegmentum** , and the **cerebral peduncles**

colliculi - consists of two sections of neuron: **superior colliculi** (analyze visual signals from the surroundings and send them to the occipital lobe) , **inferior colliculi** (process auditory signals from the ears and transmit them to the **thalamus** [a structure above the brainstem that carries signals to the cerebrum])

tegmentum - portion that extends along the length of the brainstem; divided into three sections identified by their colors: the **pinkish section** [iron-rich, controls a person's coordination] , the **gray section** [periaqueductal gray, controls the ability to suppress pain] , and the **substrate sigma** [dark pigmented neuron cluster, controls the synthesis of the **dopamine hormone** and the mediation of body movements and motor functions]

cerebral peduncles - bundles of nerve fibers at the back of the midbrain, behind the thalamus (passageways for signals that are travelling from the cerebral cortex to other parts of the central nervous system particularly the coordination of body movements)

Midbrain



3 : Hindbrain

- positioned at the *lower back area of the brain*

- includes parts that are necessary for **breathing** and the **beating of the heart**

- has three primary parts : the **pons** , **medulla oblongata** , and **cerebellum**

pons - bulbous area situated beneath the midbrain, bridging the cerebral cortex and the brainstem (to process **communication signals** between **two major brain hemispheres** and the **spinal cord**) ; contains 4 of 12 **cranial nerves** [the **abducens nerve** (responsible for eye movements) , the **trigeminal nerve** (controls chewing and transports sensory information between the head and the faces) , the **vestibulocochlear nerve** (controls the sense of hearing and balance) , and the **facial nerve** (manages coordination of the body movements and sensation in the face)]