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

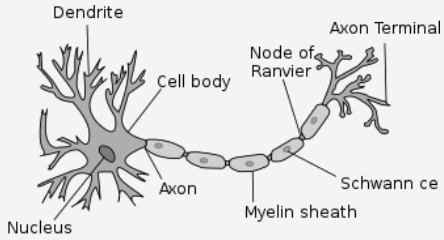
- **nerve cells** called *neurons* carry out the *main functions* of the *nervous system*

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



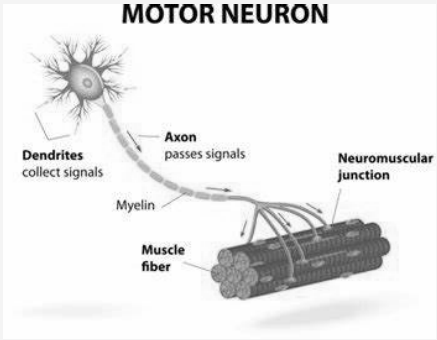
Three Main Sections of Neurons

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**

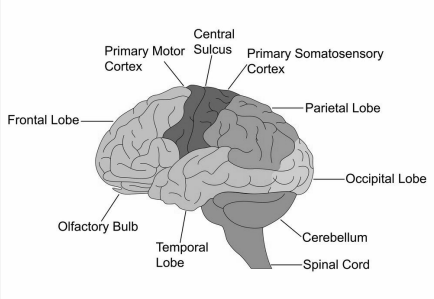
frontal lobe - located at the *forefront of the cerebral structure* divided into the **motor cortex** (*topmost portion that controls the motor functions and voluntary actions of an individual*) and the **prefrontal cortex** (*governs personality traits, cognitive functions, memory, decision-making process,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

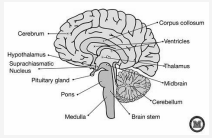
- has *three main parts* ; the **tectum** / **colliculi** , the **tegmentum** , and the **cerebral peduncles**

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*)