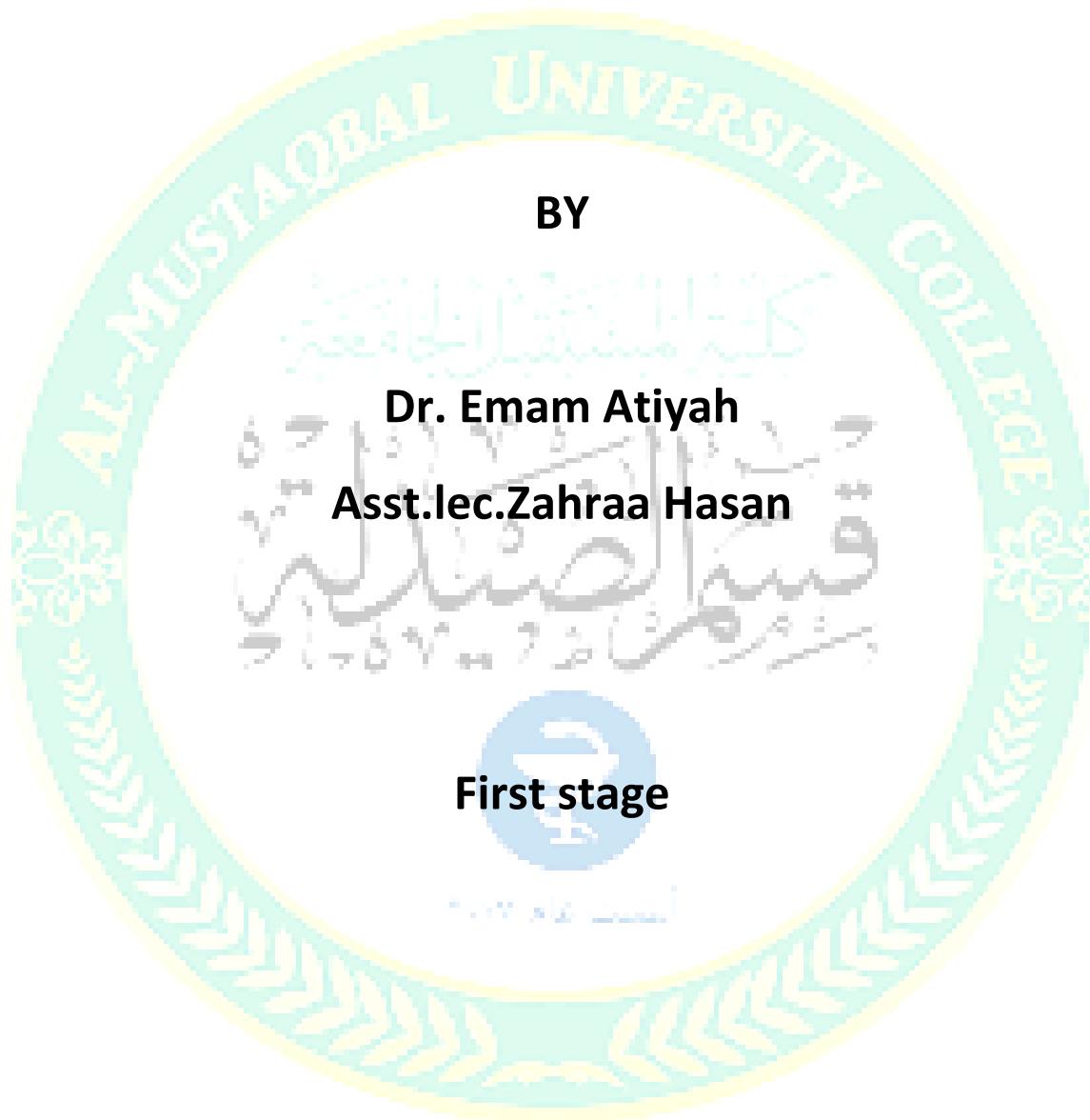


The Nervous system (central & peripheral)



BY

Dr. Emam Atiyah

Asst.lec.Zahraa Hasan

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Introduction

- The **nervous system** is a complex regulatory system, which controls, and coordinates activity, and functions throughout the body, internally and externally, by sending, receiving, and sorting electrical impulses.
- The human nervous system contains about 300 billion cells, which can be classified into thousands of different types.
- A neuron, or nerve cell, is the basic unit of the nervous system structure.
- The brain alone contains about 86 billion of neurons

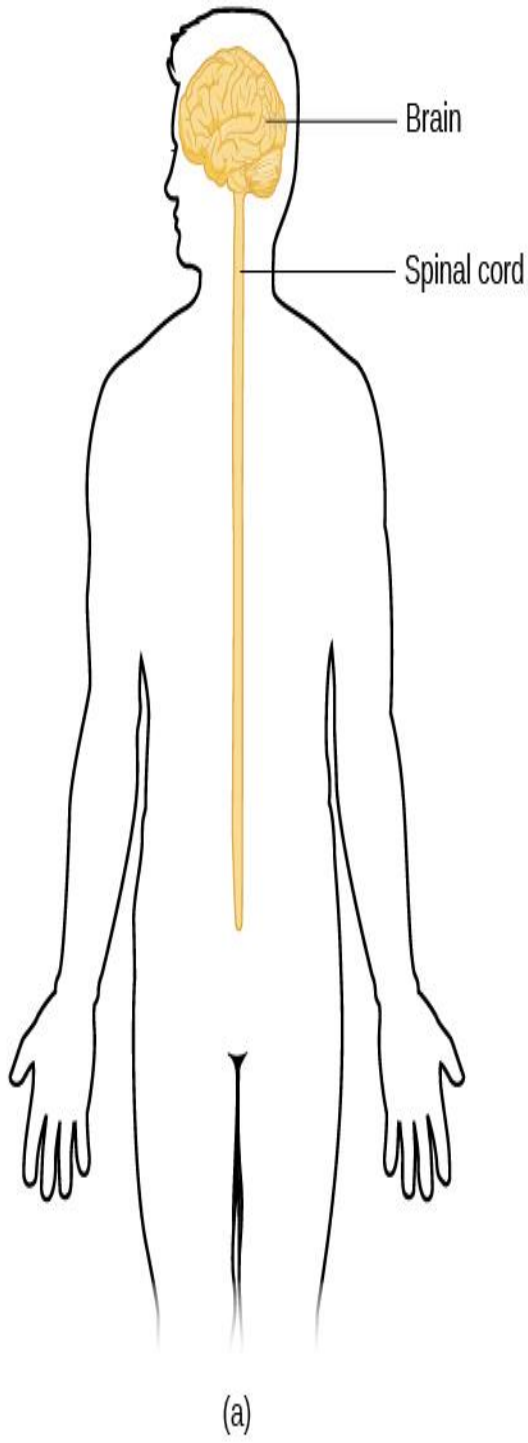
The nervous system consists of:-

- 1- The central nervous system which includes (brain and spinal cord)
- 2- The peripheral nervous system which includes (nerve fibers extending from the brain and spinal cord that carry information between the central nervous system and rest of the body)

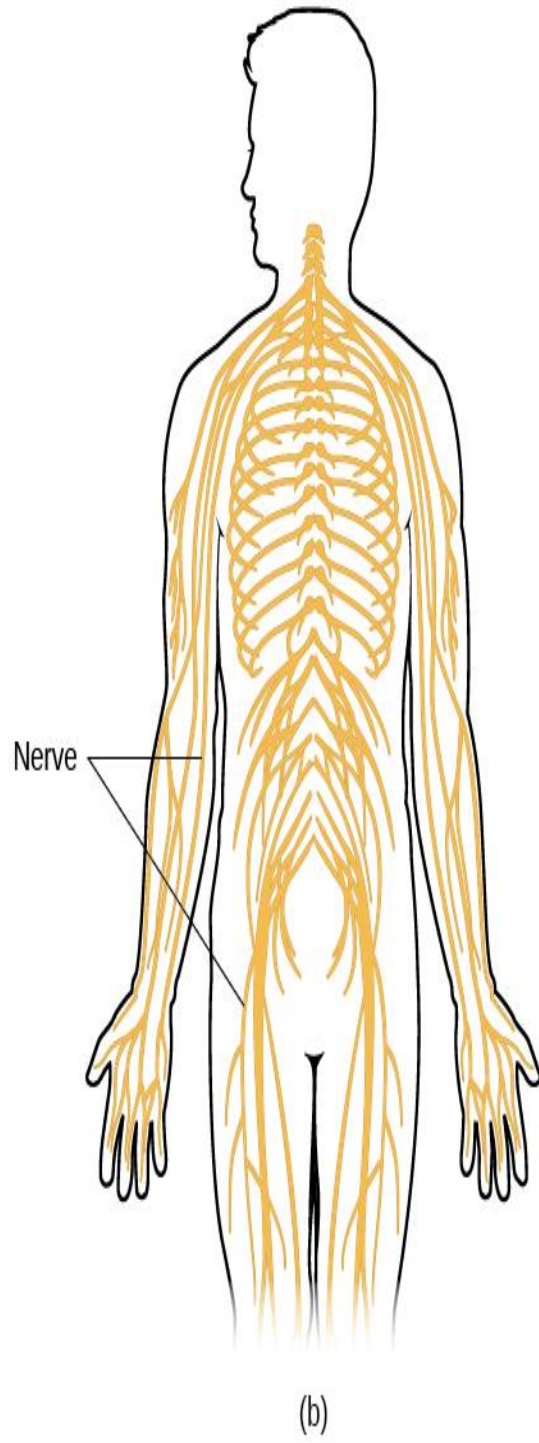
The peripheral nervous system is further divided into two parts:-

- a) The afferent (sensory) system: - which carries messages from other parts of the body to the central nervous system.
- b) The efferent (motor) system: - which carries messages from the central nervous system to the other parts of the body.

Central Nervous System



Peripheral Nervous System

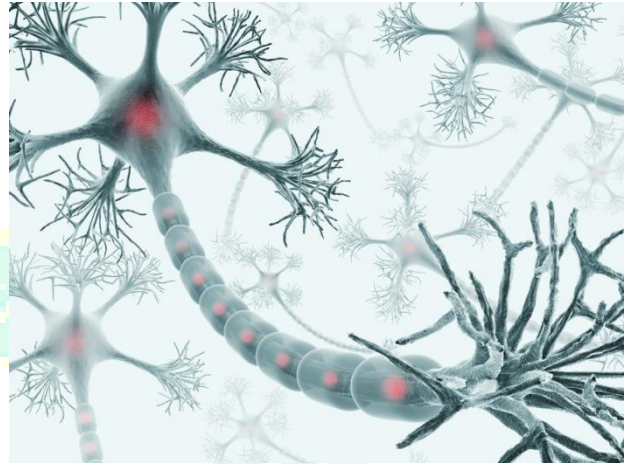


General Functions of the Nervous System:

a-Receiving stimuli (sensory function)

b-Deciding about stimuli (integrative function)

c-Reacting to stimuli (motor function)



Cell types in neural tissue:

1-Neurons

2-Neuroglial cells (also known as neuroglia, glia, and glial).

Neuron (nervous cell)

The active components of the nervous system are the nerve cells or neurons. The human nervous system contains somewhere of the order of 1020 neurons. These neurons are the units that communicate with one another and with the various effector organs. The essential aims of neuroscience are to understand.

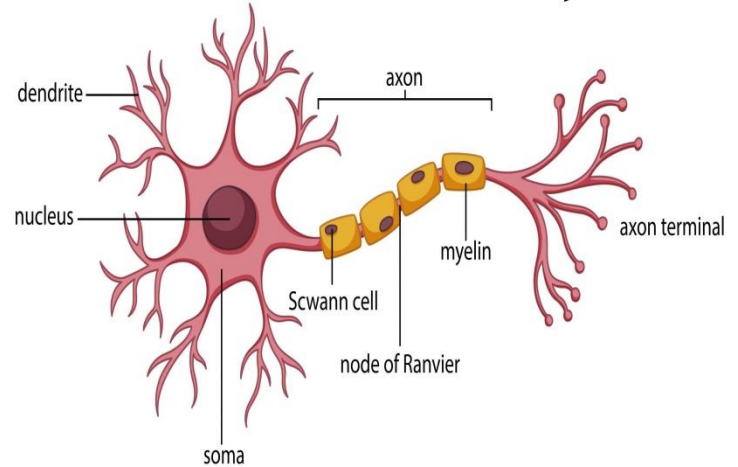
Neurons, also known as nerve cells, send and receive signals from your brain. While neurons have a lot in common with other types of cells, they're structurally and functionally unique.

Specialized projections called axons allow neurons to transmit electrical and chemical signals to other cells. Neurons can also receive these signals via rootlike extensions known as dendrites.

At birth, the human brain consists of an estimated 100 billion neurons. Unlike other cells, neurons don't reproduce or regenerate. They aren't replaced once they die.

The creation of new nerve cells is called neurogenesis. While this process isn't well understood, it may occur in some parts of the brain after birth.

Neuron Anatomy



Parts of a neuron

Neurons vary in size, shape, and structure depending on their role and location. However, nearly all neurons have three essential parts: a cell body, an axon, and dendrites.

1-Cell body (soma)

Also known as soma, the cell body is the neuron's core. The cell body carries genetic information, maintains the neuron's structure, and provides energy to drive activities. Like other cell bodies, a neuron's

soma contains a nucleus and specialized organelles. It's enclosed by a membrane which both protects it and allows it to interact with its immediate surroundings.

2-Axon

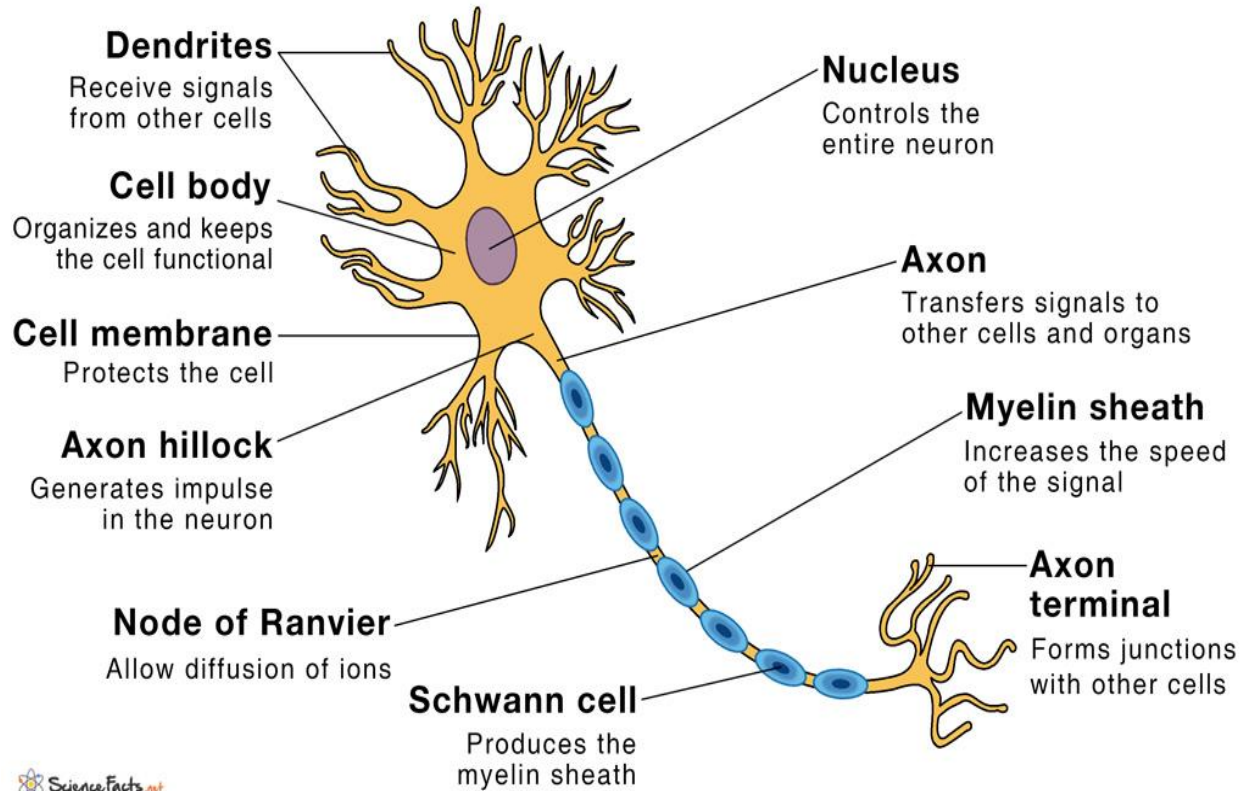
An axon is a long, tail-like structure that joins the cell body at a specialized junction called the axon hillock. Many axons are insulated with a fatty substance called myelin. Myelin helps axons to conduct an electrical signal. Neurons generally have one main axon

3-Dendrites

Dendrites are fibrous roots that branch out from the cell body. Like antennae, dendrites receive and process signals from the axons of other neurons. Neurons can have more than one set of dendrites, known as dendritic trees.

For instance, Purkinje cells are a special type of neuron found in the cerebellum. These cells have highly developed dendritic trees which allow them to receive thousands of signals.

Parts of a Neuron with Functions



In terms of function, scientists classify neurons into three broad types: **sensory**, **motor**, and **interneurons**.

1-Sensory neurons help you: taste, smell, hear, see and feel things around you.

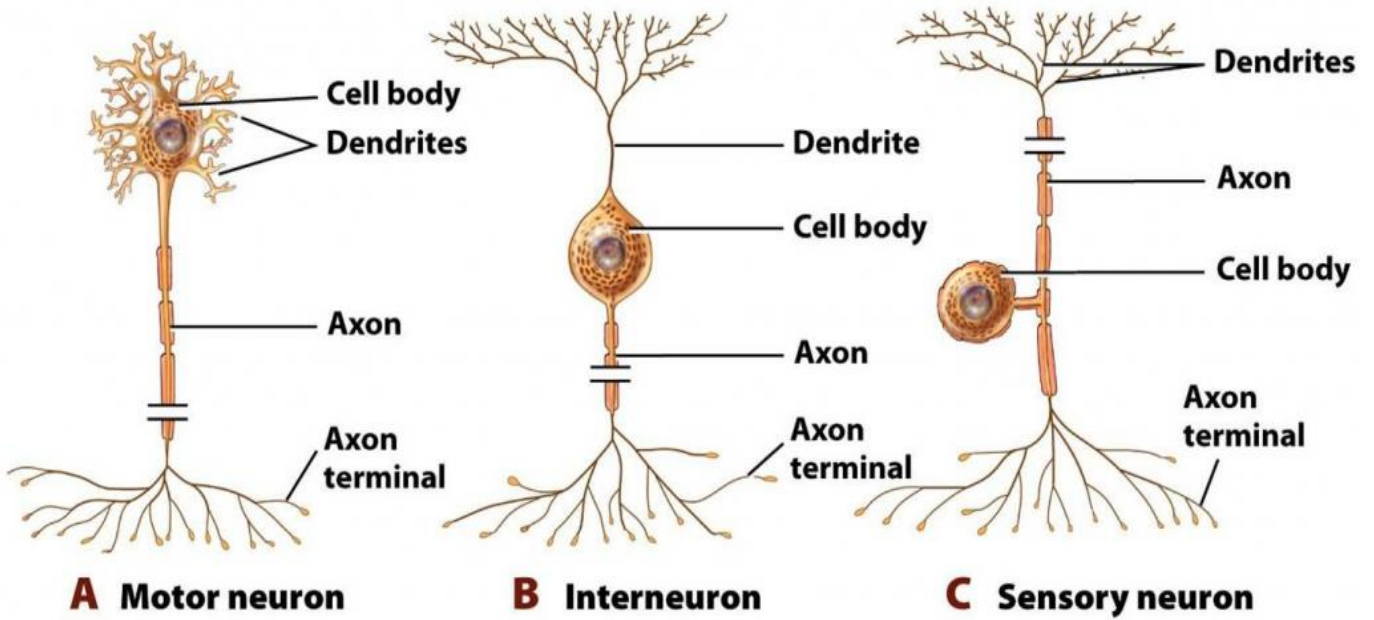
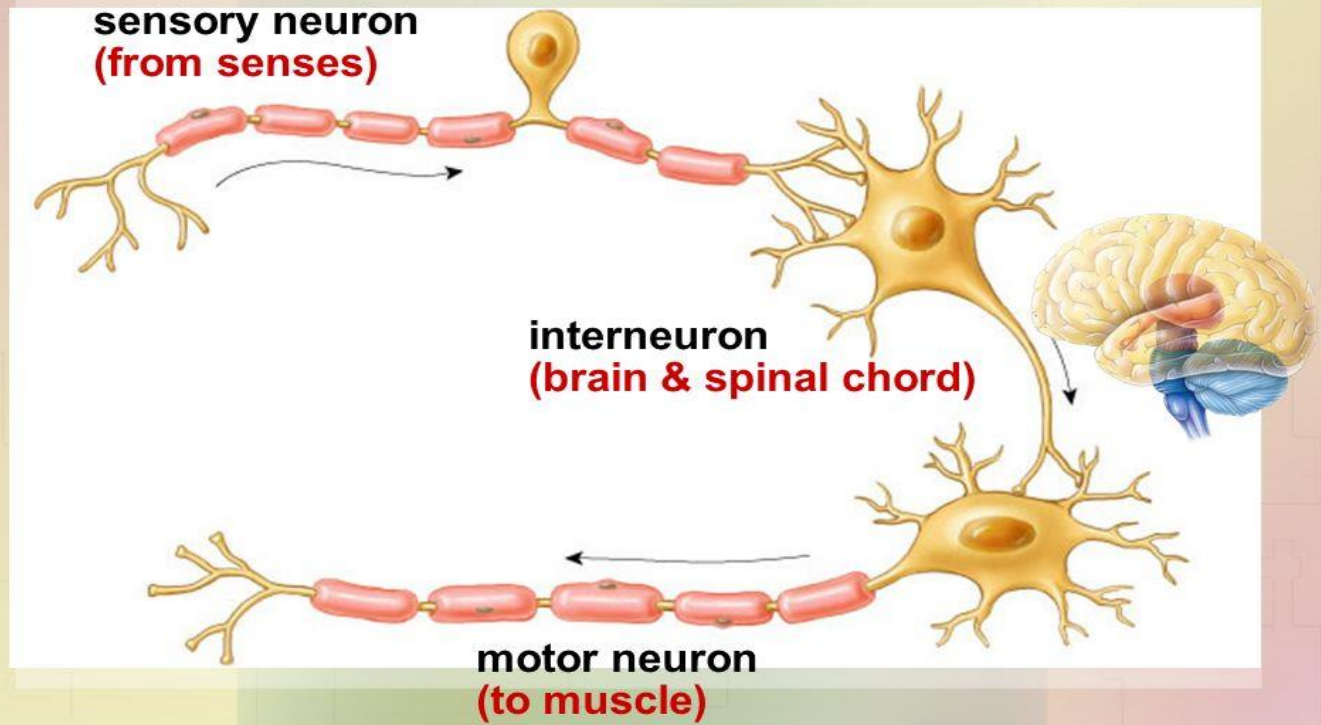
2-Motor neurons play a role in the movement, including voluntary and involuntary movements. These neurons allow the brain and spinal cord to communicate with muscles, organs, and glands all over the body.

Ex: - when you eat, lower motor neurons in your spinal cord send signals to the smooth muscles in your esophagus, stomach, and intestines. These muscles contract, which allows food to move through your digestive tract.

3-Interneurons are neural intermediaries found in the brain and spinal cord. They're the most common type of neuron. They pass signals from sensory neurons and other interneurons to motor neurons and other interneurons.

Ex: - when you touch something hot, sensory neurons in your fingertips send a signal to interneurons in your spinal cord. Some interneurons pass the signal on to motor neurons in your hand, which allows you to move your hand away. Other interneurons send a signal to the pain center in your brain, and you experience pain.

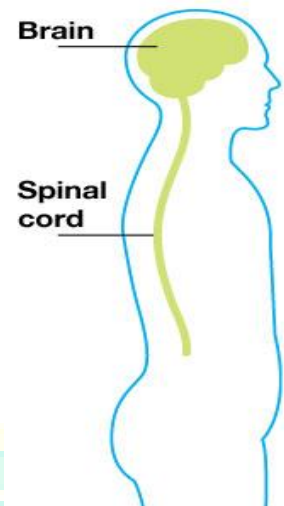
Types of neurons



Central nervous system (CNS)

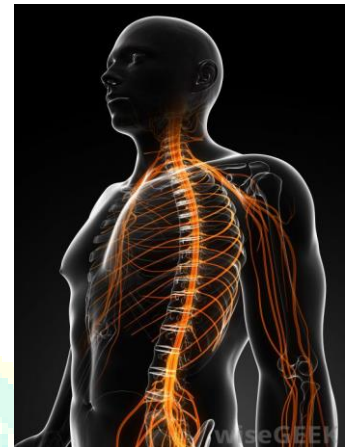
The central nervous system consists of the brain and spinal cord and the neurons (or nerve cells). It is referred to as “central” because it combines information from the entire body and coordinates activity across the whole organism. The CNS receives sensory information from the nervous system and controls the body's responses. The CNS is differentiated from the peripheral nervous system, which involves all of the nerves outside of the brain and spinal cord that carry messages to the CNS. The central nervous system plays a primary role in receiving information from various areas of the body and then coordinating this activity to produce the body's responses.

Since the CNS is so important, it is protected by a number of structures. First, the entire CNS is enclosed in bone. The brain is protected by the skull, while the spinal cord is protected by the vertebra of the spinal column. The brain and spinal cord are both covered with a protective tissue known as meninges.



Peripheral nervous system (PNS)

The PNS is all the nerves that branch out from the CNS components and extend to other parts of the body – to the sense organs, muscles, and glands. The PNS connects the CNS to the rest of the body.

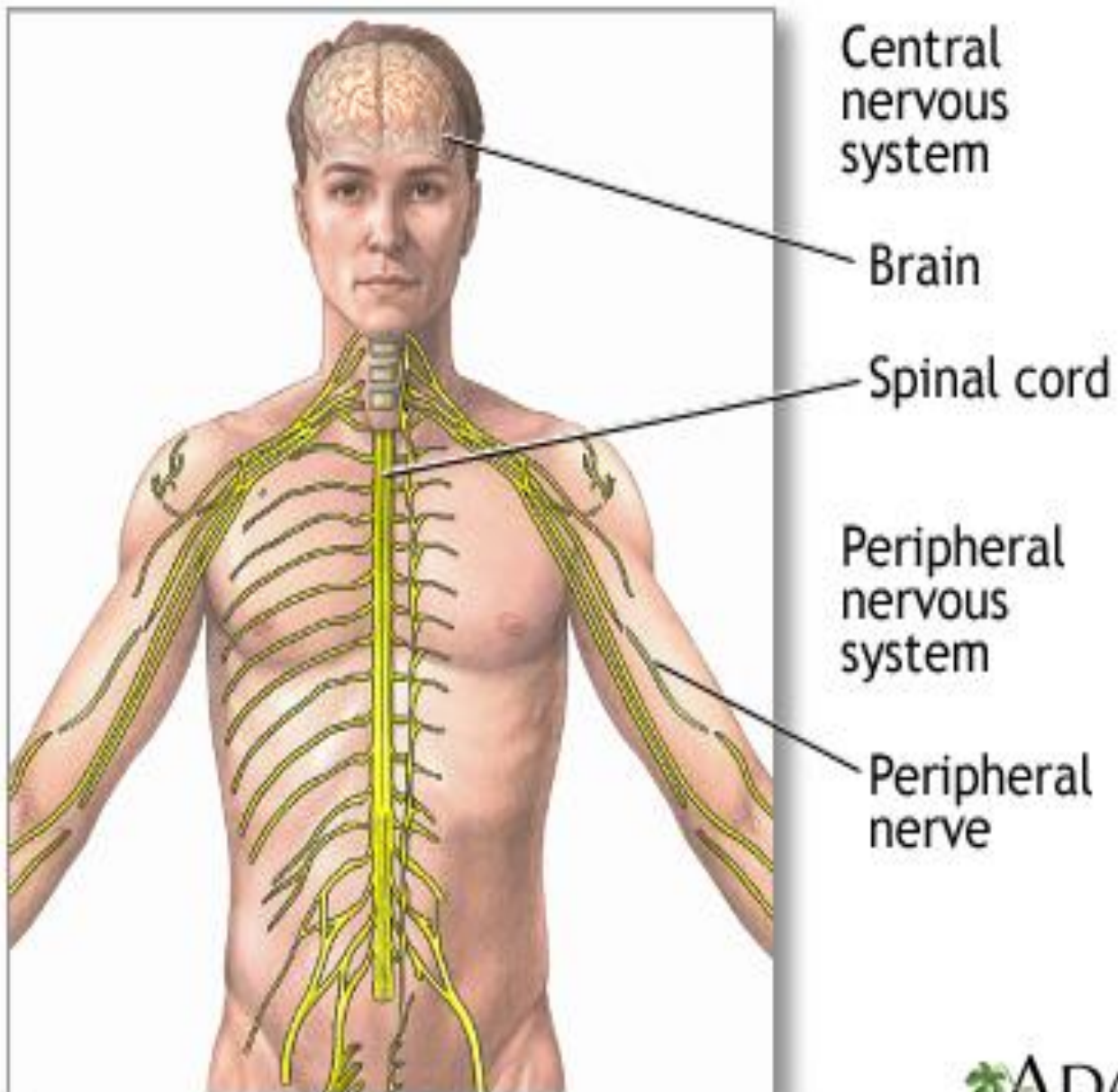


❖ The primary function of the peripheral nervous system:

- 1- connect the brain and spinal cord to the rest of the body and the external environment.
- 2- The peripheral nervous system transmits information to and from the CNS. This is accomplished through nerves that carry information from sensory receptors in the eyes, ears, skin, nose and tongue, as well as stretch receptors and nociceptors in muscles, glands and other internal organs.
- 3- Also PNS are voluntary movements such as chewing food, walking, and facial expressions. The PNS also regulates autonomic functions such as breathing, heart rate, and digesting – the unconscious bodily behaviors.

What is the Difference Between CNS and PNS?

(H.W)



Effects of Drugs on the Nervous System

Drugs produce their effect on the body through two major processes. The first is the effect of the chemical properties of the drug on the central nervous system (CNS) which includes the brain and the spinal cord, this process is called pharmacodynamics. The second is how the drugs enter, are metabolized, and absorbed by the body, this process is known as pharmacokinetics. These two processes work together to produce a certain effect.

Neurotransmitters, drugs can speed up (CNS stimulants) or slow down (CNS depressants) the transfer of electrochemical messages between neurons in the brain. Messages between neurons can also be distorted when hallucinogenic drugs are taken. ~~Neurotransmitters, drugs can speed up (CNS stimulants) or slow down (CNS depressants) the transfer of electro-chemical messages between neurons in the brain. Messages between neurons can also be distorted when hallucinogenic drugs are taken.~~

1. **Alcohol**:- central nervous system depressant – cell membranes are highly permeable to alcohol so once in the bloodstream it can diffuse into almost all body tissues. It is absorbed in the stomach so it gets into the bloodstream quickly and slows down the function of the nervous system
2. **Caffeine**:- acts as a central nervous system stimulant - caffeine suppresses melatonin for up to 10 hours and also promotes adrenalin. Melatonin is strongly associated with quality sleep, while adrenalin is the neurotransmitter associated with alertness.

3. **Nicotine**:- small doses of nicotine have a stimulating action on the central nervous system – it is highly addictive nicotine's effects on the brain cause an increased release of neurotransmitters associated with pleasure. The brain quickly adjusts to repeated nicotine consumption by decreasing the amount of neurotransmitters released. The effect of this increased tolerance is that the smoker must continue to use nicotine in order to avoid the feelings of discomfort associated with withdrawal from the drug. Irritability and anxiety often ensue during nicotine withdrawal.
4. **Marijuana**:- THC, the main active ingredient in marijuana, binds to membranes of nerve cells in the central nervous system that have protein receptors. After binding to nerve cells, THC initiates a chemical reaction that produces the various effects of marijuana use. One of the effects is suppression of memory and learning centers (called the hippocampus) in the brain.