



**Shree H. N. Shukla Institute of Pharmaceutical
Education and Research, Rajkot**

**B. Pharm
Semester-II**

**Subject Name: Human Anatomy & Physiology-II
Subject Code: BP201TP**

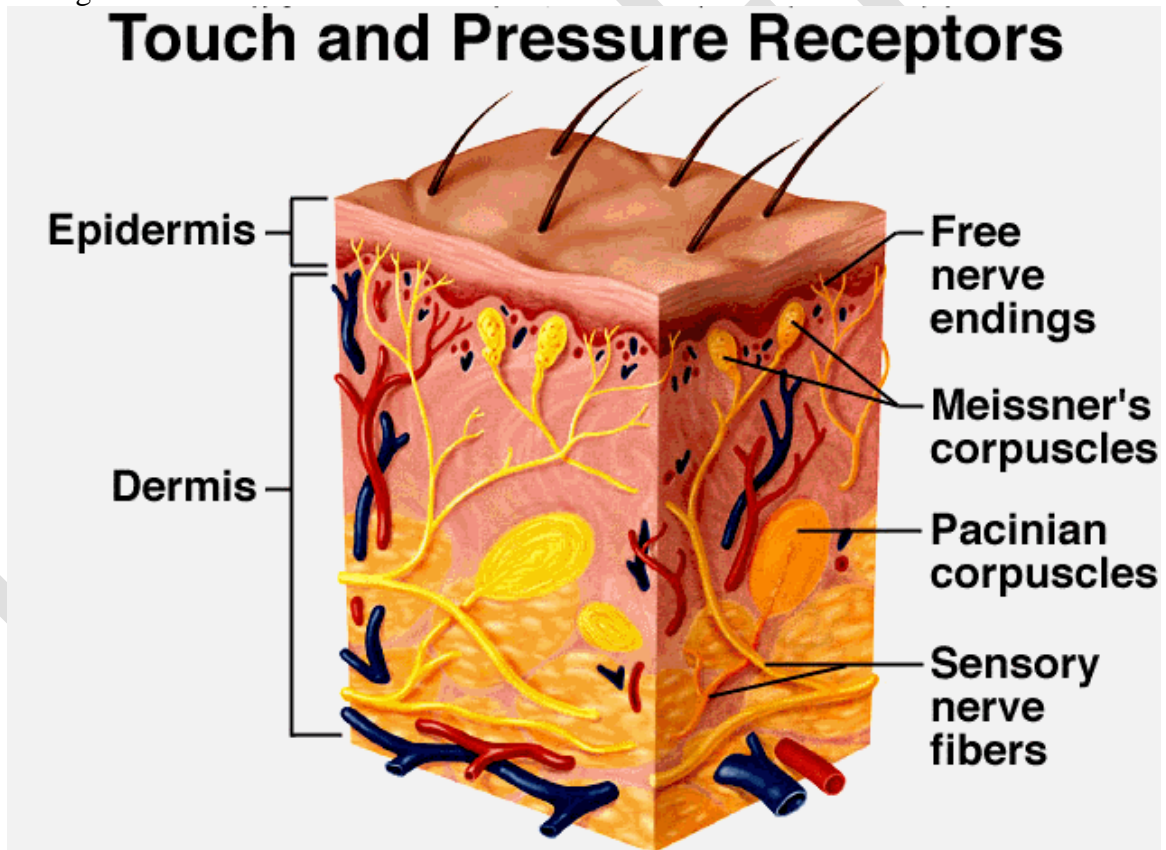
Chapter-1 Nervous System

What is the nervous system?

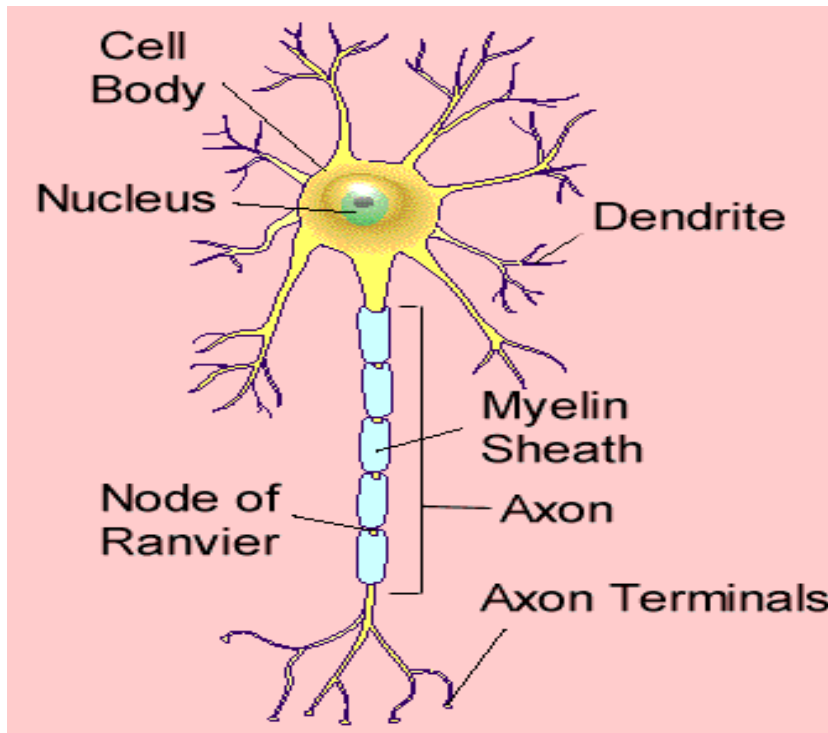
- The nervous system consists of two divisions: the central nervous system containing the brain and spinal cord, and the peripheral nervous system which is a network of nerves and neural tissues branching out throughout the body.

Types of neurons

- Neurons are the nerve cells, the structural and functional units of the nervous system.
- They conduct impulses that enable the body to interact with its internal and external environments.
- There are various types of neurons. The tissues that support the nerve cells is called neuroglia.



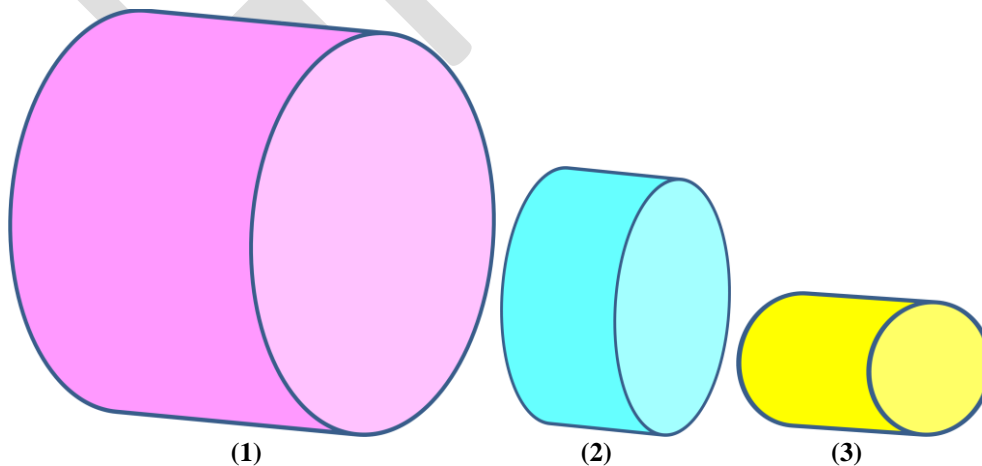
- 1) The motor neurons usually have one axon and several dendrites.
 - The axon is covered with a insulating fatty layer called a myelin sheath, and transmits signals a long distance from the neuron to the area to be activated. Dendrites are short and unsheathed.
 - Motor neurons cause muscle contractions and control secretions from glands and organ controlling body functions.



2) Sensory neurons do not have true dendrites. They are attached to sensory receptors and transmit impulses to the central nervous system, which then stimulates the interneurons, and then motor neurons.

NERVE RECEPTORS \Rightarrow **SENSORY NEURONS** \Rightarrow **INTERNEURONS** \Rightarrow **MOTOR NEURONS**

Interneurons are located entirely within the central nervous system. They intercept the impulses from the sensory neurons and transmit the signals to the motor neurons.



1) Schwann cells, only found on peripheral nerves which can regenerate

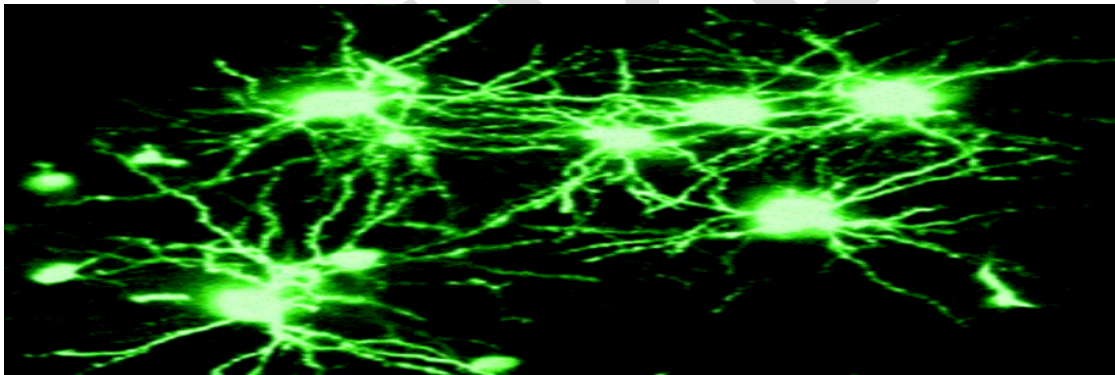
2) Myelin sheath, a fatty layer of insulation on some nerve fibers

3) The axon that transmits the message

- There are no Schwann cells on nerve fibers in the central nervous system, therefore damage to those nerve fibers is not reversible.
- A bundle of nerve fibers is simply called 'a nerve'.
- AFFERENT nerves conduct impulses to the central nervous system; EFFERENT nerves conduct impulses to the muscles, organs, and glands.

Synapses

- Nerve impulses are transmitted via branches called synapses. The synapses are connectors hooking dendrites and axons from one neuron to another.
- The number of synapses influences transmission. That number can decrease with disease, lack of stimulation, drug use, etc.



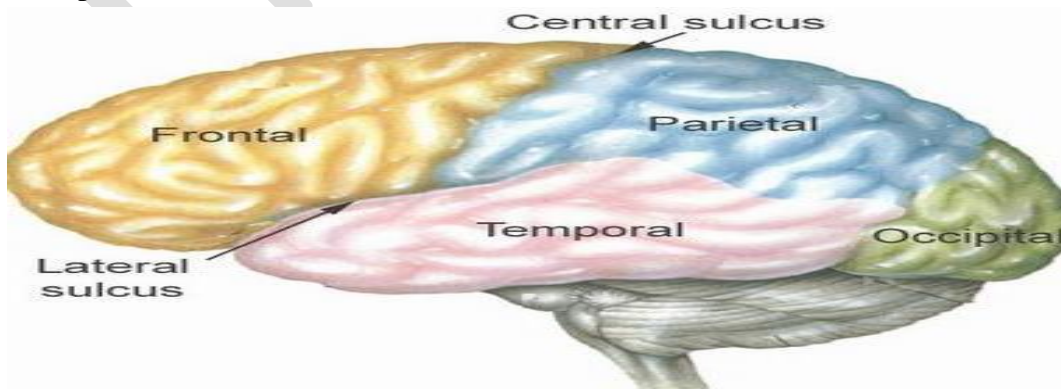
Gray and white matter of the central nervous system

- The brain and spinal cord of the central nervous system receive impulses, process the information, and respond with the appropriate action.
- Gray matter of the brain and spinal cord consists of unsheathed nerve fibers (cannot be regenerated if damaged) in the cortex or surface layer. The white matter makes up the internal structure, and consists of myelinated nerve fibers.

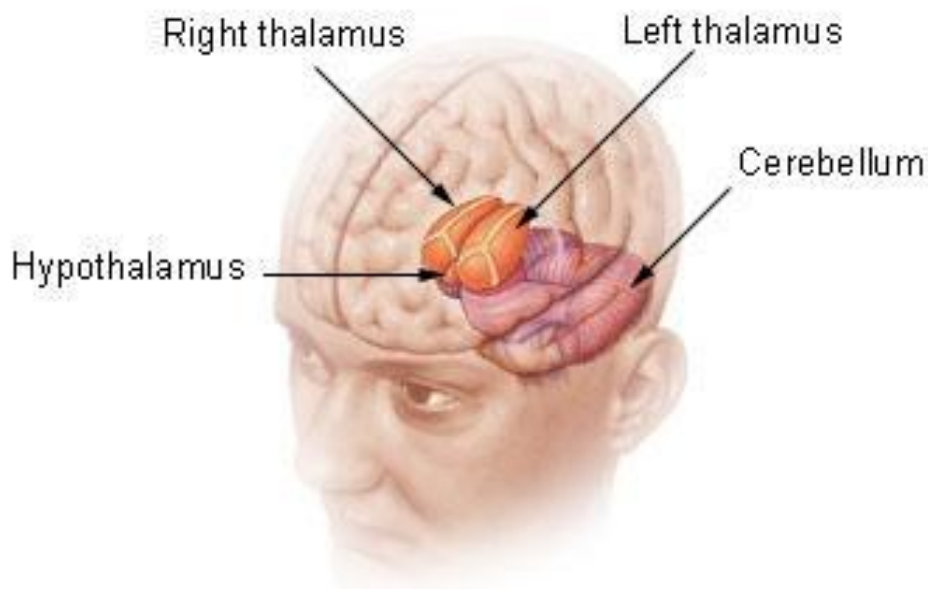
Parts of the brain & The cerebrum



- Taking up 7/8ths of the brain's weight, the cerebrum governs all sensory and motor activity. This includes sensory perception, emotions, consciousness, memory, and voluntary movements.
- It is divided into the left and right hemispheres. The surface or cortex is arranged in bulging folds, each one called a gyrus and furrows, each one called a sulcus
- The cortex is also divided into 4 lobes that correspond to the overlying bones of the skull: the frontal lobe specializes in motor activity, personality, and speech; the parietal lobe is where language, temperature, pressure, touch are interpreted;
- the temporal lobe contains centers for hearing, smell, and language input; the occipital lobe specializes in vision.



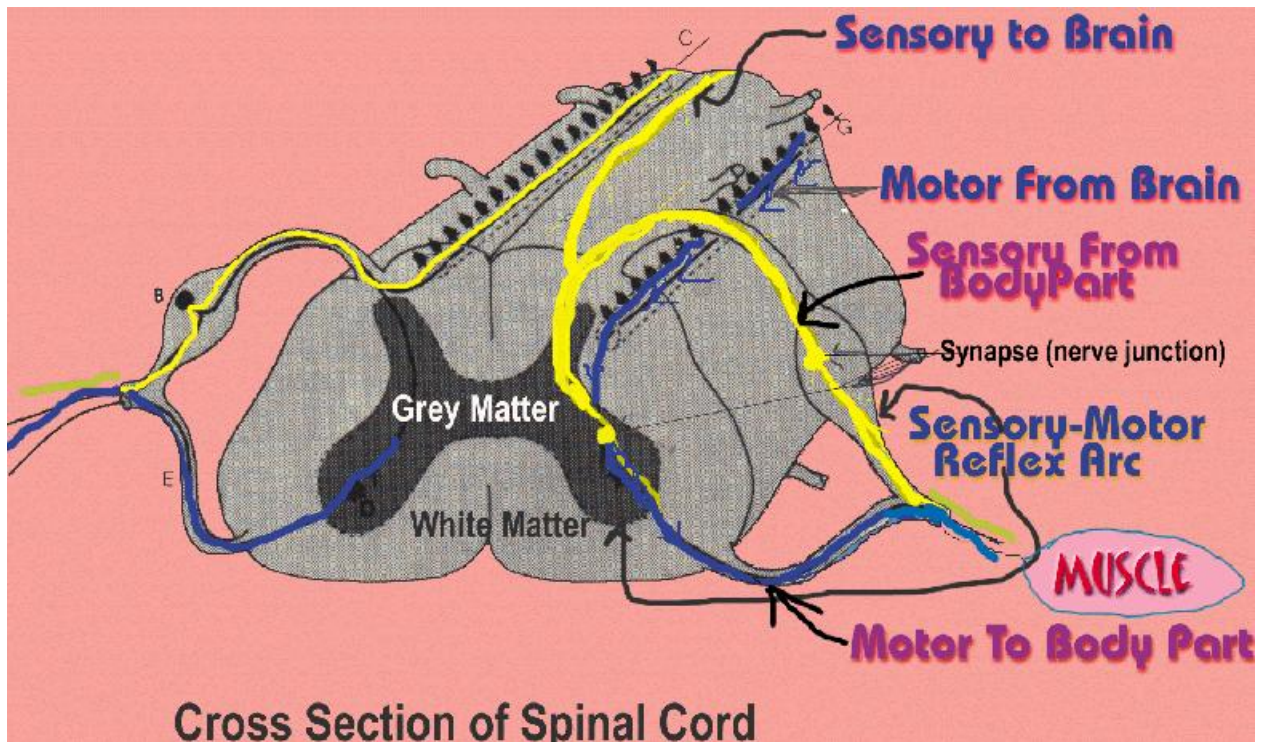
- The cerebellum is the second largest part of the brain. It contains nerve fibers that connect it to every part of the central nervous system. It coordinates voluntary and involuntary patterns of movements. It also adjusts muscles to automatically maintain posture.
- The hypothalamus regulates behavior and emotional expression, body temperature, and many metabolic activities. Attached to the pituitary gland, it also controls hormonal secretions of this gland.



- The brainstem consists of 3 structures: the gray matter of the midbrain control visual reflexes and sense of hearing. The white matter of the pons plays a role in regulating visceral (internal organ) control.
- The medulla oblongata connects the rest of the brain to the spinal cord. It regulates breathing, swallowing, coughing, sneezing, vomiting, heartbeat, and blood pressure

The spinal cord

- The spinal cord has 31 segments: 8 cervical segments that correspond to the C1-C8 vertebrae; 12 thoracic segments corresponding to the T1-T12 vertebrae; 5 lumbar segments corresponding to L1-L5 vertebrae, 5 sacral segments corresponding to S1-S5 vertebrae, and 1 coccygeal segment.
- The 44 cm long spinal cord is shorter than the spinal column, so segments do not perfectly correspond to the vertebrae.



- At each segment of the spinal cord, left and right pairs of sensory and motor nerves branch out and connect to the peripheral nervous system. Impulses travel back and forth to the brain and back to the muscles.

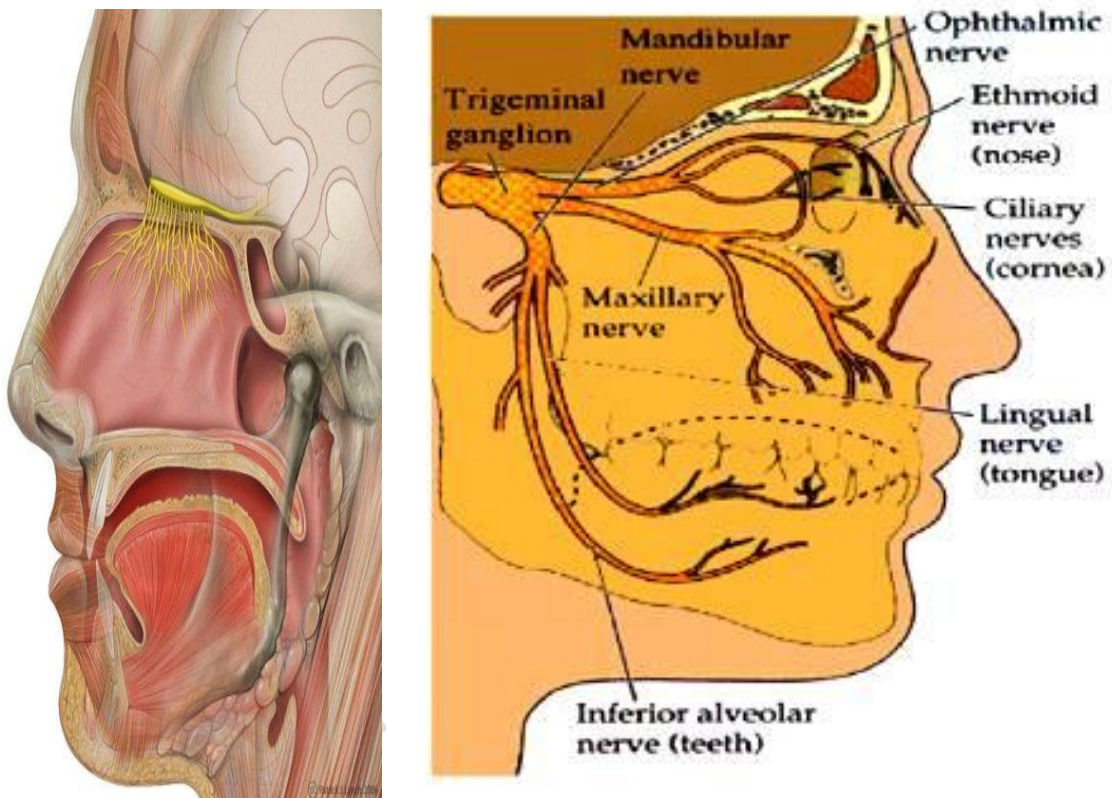
Cerebrospinal fluid

- A colorless fluid is produced in the ventricles of the brain; it surrounds the brain and spinal cord. It is called cerebrospinal fluid, and it cushions the brain and cord from shocks that could cause injury. It is maintained at a level around $1/2 - 2/3$ cup.

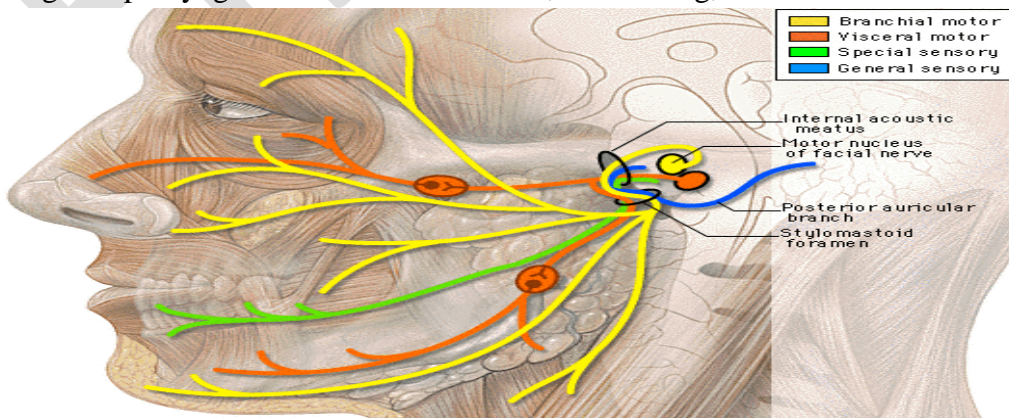
Peripheral nervous system

- The network of nerves branching out throughout the body from the brain and spinal cord is called the peripheral nervous system. In addition to the 31 pairs of spinal nerves mentioned in the slides on the spinal cord, there are 12 pairs of cranial nerves that attach to the brain:

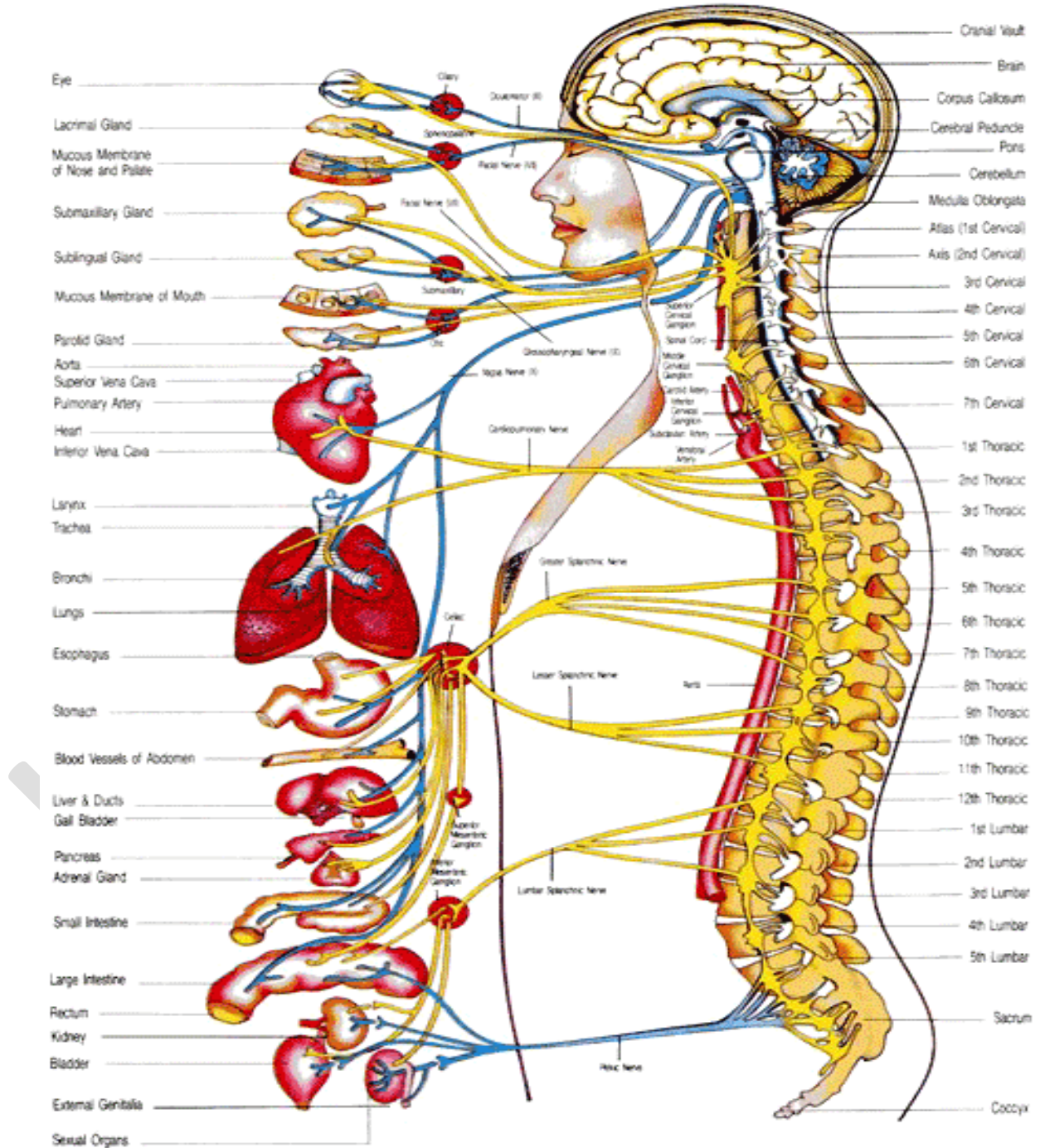
- I. The olfactory nerve carries sensory input for smell
- II. The optic nerve carries sensory input for vision
- III. The oculomotor nerve controls muscles of the eye and eyelid
- IV. The trochlear nerve controls the eyeball



- The trigeminal nerve (try JEM ĩ nul) controls the face, nose, mouth, forehead, top of head, and jaw.
- The abducens nerve (ab DŪ senz) also controls the eyeball
- The facial nerve controls muscles of the face and scalp, and part of the tongue for sense of taste
- The auditory or cochlear nerve provides sensory input for hearing and equilibrium.
- The glossopharyngeal nerve controls saliva, swallowing, and taste.



- X. The vagus nerve is the longest cranial nerve, extending to and controlling the heart, lungs, stomach, and intestines.
- XI. The accessory nerve permits movement of the head and shoulders.
- XII. The hypoglossal nerve controls the muscles of the tongue.



- The sympathetic nervous system is responsible for the 'flight or fight' responses... increased alertness, metabolic rate, respiration, blood pressure, heart rate, and sweating AND a decrease in digestive and urinary function. The parasympathetic nervous system counteracts the responses of the sympathetic system... restoring homeostasis.

