

Nervous System

The nervous system is divided into two parts:

1. Central nervous system - the brain and spinal cord
2. Peripheral nervous system - all of the afferent and efferent nerves off of the spinal cord as well as the cranial nerves.

The functions of the nervous system are:

1. orientation of the body to its internal and external environments.
2. coordination and control of body activities.
3. assimilation of experiences requisite to memory, learning, and intelligence.
4. programming of instinctual behavior.

Brain development - The brain forms from the neural tube. By the 4th week there are three distinct areas:

1. Prosencephalon (forebrain)
 - a. telencephalon - eventually becomes the hemispheres of the cerebrum.
 - b. diencephalon
2. Mesencephalon (midbrain)
3. Rhombencephalon (hindbrain)
 - a. metencephalon
 - b. myelencephalon

Telencephalon - becomes the hemispheres of the brain.

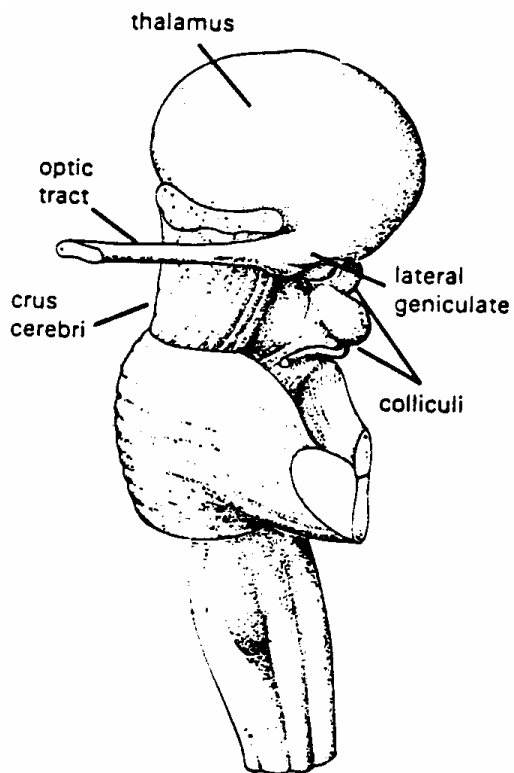
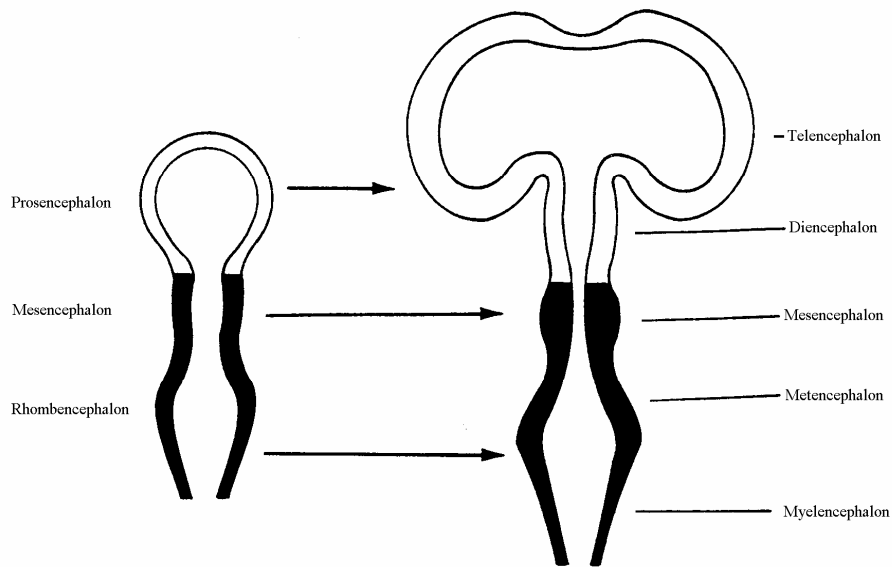
Diencephalon:

1. epithalamus
2. thalamus
3. pineal gland
4. hypothalamus
5. pituitary gland

Cerebral peduncles - carry fibers from the cerebrum through the midbrain.

Metencephalon - expands to form the pons and the cerebellum

Myelencephalon - forms the medulla oblongata



The spinal cord develops from the neural tube. Notice that you are born with all of the neurons that you are ever going to have. As you grow, they grow. They do not multiply.

Neurons (nerve cells) - are the basic structural and functional units of the nervous system.

There are approximately 10 Billion neurons in the human body.

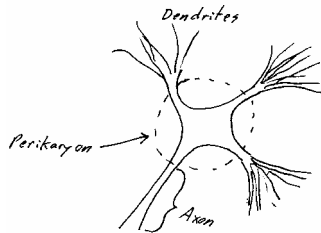
Neurons have the unique ability to transmit impulses.

Information into the CNS - afferent

Information out from the CNS - efferent

All neurons have three parts:

1. cell body (perikaryon)

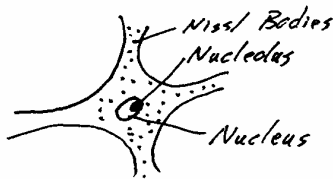


Has a centrally located prominent nucleus

Usually has a prominent nucleolus

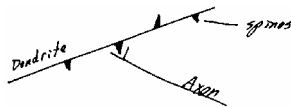
Has Nissl Bodies which are dense accumulations of RER and Polyribosomes for making proteins.

Will also find some Nissl substance in the dendrites, NEVER in the axon. Also see Golgi, Mitochondria, some melanin pigment (substantia nigra), and some tubules and filaments.



2. dendrites - antennae of a neuron

Contents much the same as the perikaryon.



Also see dendritic spines or Gemules. These are spots where another neuron is contacting a dendrite. There may be as many as

100,000 other neurons synapsing on any given neuron.

3. an axon

1. No Nissl bodies

2. plasmalemma is called the axolemma

3. cytoplasm is called the axoplasm

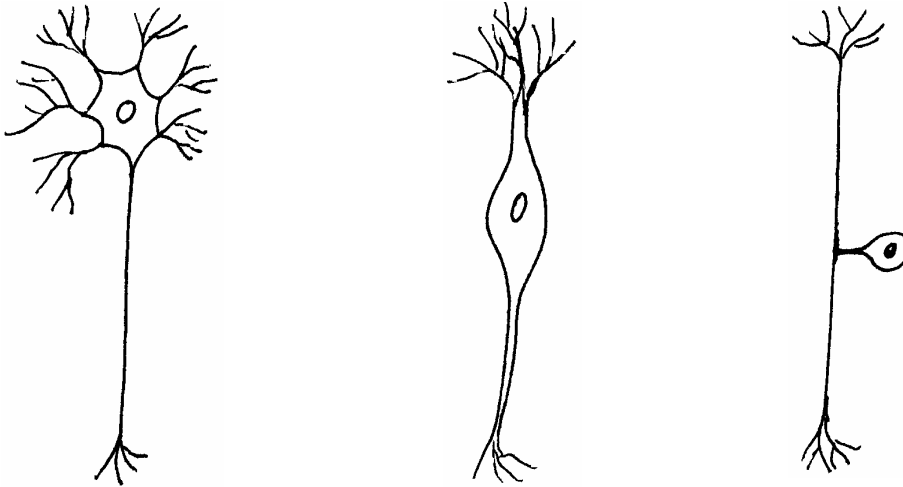
4. Axon originates from the cell body in an area called the axon hillock

5. No RER or Golgi

6. Many neurofilaments and neurotubules

7. Membrane bound vesicles. These vesicles demonstrate axoplasmic flow. These Vesicles transport neurotransmitter, made in the cell body, to the end of the axon. There is also flow back to the cell body. This is known as retrograde flow. This mechanism lets the neuron know that one of its processes is damaged.

There are three types of neurons and they are classified by their number of cellular processes.



1. Multipolar - several dendrites and one axon. e.g., motor neuron (ventral horn cell)
2. Bipolar - have a process at each end. This type of neuron is relatively rare. They are found in acoustic and vestibular nuclei associated with CN VIII, they act as olfactory receptors in CN I, and they are also found in the retina.
3. Pseudounipolar - single process that divides into two (sensory neuron)

Neuroglia cells - are support cells for the neurons. There are 6 types of neuroglia cells:

1. neurolemmocytes (Schwann cells) - are responsible for the formation of myelin in the PNS.
2. oligodendrocytes - are responsible for formation of myelin in the CNS.
3. microglia - are phagocytic cells of the CNS.
4. astrocytes - help form part of the blood-brain barrier.
5. ependyma - cells that line the ventricles and the central canal of the spinal cord.
6. satellite cells - provide structural support for neurons in the ganglia of the PNS.

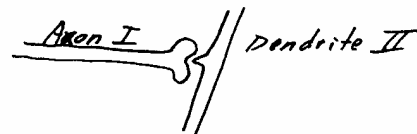
The area where two (usually) neurons come into contact is called a synapse.

Functionally there are two types of synapses:

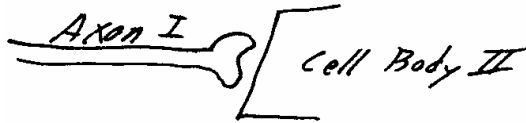
1. electrical synapse. These are found at gap junctions and are still poorly understood.
2. chemical synapse. Here the two neurons are separated by a space. A chemical messenger is released from one cell and traverses the space to exert an effect on the other cell. The messenger is called a Neurotransmitter and is usually Acetylcholine (Ach) or Epinephrine.

Structurally there are 4 types of synapses

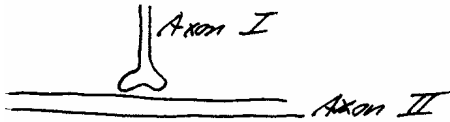
1. axodendritic- axon of one cell to a dendrite of another cell



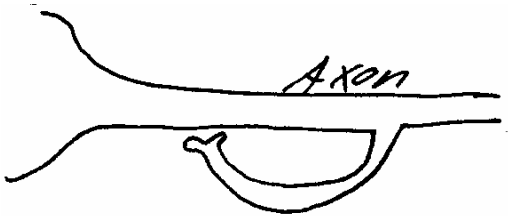
2. axosomatic - axon of one cell to the cell body of another cell



3. axoaxonic - axon of one cell to the axon of another cell

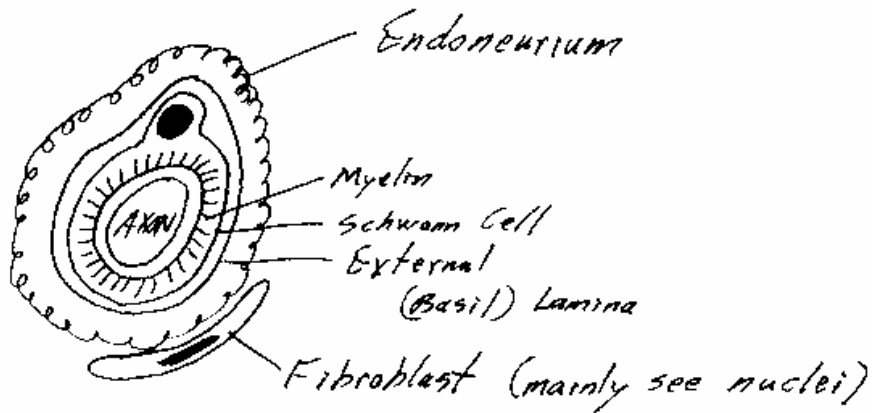


note that we may see an axon with a collateral that synapses with its own axon



4. dendrodendritic - dendrite of one cell to a dendrite of another cell

A typical neuron in cross section



Many of these make up a fascicle

Many fascicles make up a peripheral nerve

Makeup of a peripheral nerve

