Chapter 7 - The Nervous System

NERVOUS SYSTEM

- cerebrum
- cerebellum
- spinal cord
- brachial plexus
- intercostal nerve
- radial nerve
- median nerve
- ulnar nerve
- lumbar plexus
- sciatic nerve
- common peroneal nerve
- superficial peroneal nerve
The human body has a very complex job in keeping everything working and functioning properly.

The nervous system must coordinate millions of different functions and keep everything working properly.

The major components of the nervous system are the **brain**, **spinal cord** and **nerves**.

There are also some very specialized **sense** organs such as the **eyes**, **ears** and **skin** that help the body detect different things.
The nervous system has two main divisions:

1) **central nervous system (CNS)** – consists of the **brain** and the **spinal cord**

2) **peripheral nervous system (PNS)** – is all of the **nerves** that branch from the central nervous system
There is a division of the peripheral nervous system that is called the **autonomic nervous system (ANS)** – that regulates involuntary things like **heart rate** and **stomach contractions**.
neurons – are nerve cells that consist of three parts:

1) **cell body** – which is the main part of neuron that contains the **nucleus**

2) **dendrites** – which are branching projections that carry impulses **toward** the cell body

3) **axon** – which is a long tail-like structure that carries impulses **away** from the cell body
There are three types of neurons:

1) **sensory neurons** – which transmit impulses **toward** the spinal cord and brain from all over the body

2) **motor neurons** – transmit impulses **away** from the brain and spinal cord

3) **interneurons** – conduct the impulse from the sensory neurons to the motor neurons
Sensory neurons are also known as **afferent neurons**.

Motor neurons are also known as **afferent neurons**.

Interneurons are also known as **connecting neurons**.
A **schwann cell** – is a cell that covers the **axons** of very long peripheral nerves. This is made up of a protein called **myelin** and is called a **myelin sheath**. The myelin sheath allows signals to be transmitted very quickly.
There are constrictions in the myelin sheath, these are called **nodes of Ranvier**. A nerve impulse “bounces” down these nodes.

**neurilemma** – is the outer membrane of the Schwann cell

**glia** – are connective tissue cells

They help to support the neurons. They are the **glue** that hold the nerves together and **protects** them.
**white matter** – the nerves of the peripheral nervous system

This is called white matter because of the presence of the **myelin** sheath.

Bundles of axons in the central nervous system are called **tracts**.

**gray matter** – is nerves that do not have a myelin sheath
**synapse** – a junction between the axon end of one neuron and the dendrite or cell body of another neuron

**neurotransmitter** – is a chemical substance secreted by the terminal end of an axon that stimulates a **dendrite** of another neuron

Examples of well-known neurotransmitters are **acetylcholine**, **norepinephrine**, **dopamine** and **serotonin**.

These chemicals play an important role in **sleep**, **motor** function, **mood** and **pleasure** recognition.
**convergence** – two neurons coming into one neuron

**divergence** – one neuron branching into two neurons

**reflex** – is an automatic, unconscious response to changes occurring within the body

This is like a short cut. A lot of the time the impulse will travel to the spinal cord and directly back to cause an impulse.
The brain is divided into three main parts:

1) **cerebrum** – largest part, performs sensory and motor functions

2) **cerebellum** – coordination of voluntary muscles

3) **brain stem (medulla)** – contains the nerve pathways
The cerebrum is split into two parts called the **cerebral hemispheres**. The hemispheres are connected by a deep bridge of nerve fibers called a **corpus collosum**.
The cerebrum is split into 4 lobes that correspond to their function.

1) **frontal lobe** – motor writing center and muscle control

2) **parietal lobe** – use of words and understanding speech

3) **occipital lobe** – visual images and visual recognition of objects

4) **temporal lobe** – auditory area and memory of visual and auditory patterns
The large spaces in the brain and brain stem are called **ventricles**. These areas contain cerebrospinal fluid.
Parts of the brain stem:

1) **diencephalon** – is made up of the following parts

   a) **thalamus** – relay station for sensory impulses
   b) **hypothalamus** – homeostasis ex. heart rate, body temperature
   c) **limbic system** – emotions and expressions
   d) **pineal gland** – a gland in the brain that regulates sleep patterns
2) **midbrain** – between the diencephalon and the pons
This is the reflex center of the brain.

3) **pons** – rounded bulge on the underside of the brain stem
This is a relay center in the brain.
4) **medulla oblongata** – connects the spinal cord to the brain
The following actions are performed in the medulla oblongata.
   a) **cardiac** center
   b) **vasomotor** center
   c) **respiratory** center

5) **reticular formation** – scattered throughout the brain and wakes the brain
The cerebellum:

Is directly below the occipital portion of the cerebrum and is the second largest part of the brain.

The cerebellum senses and adjusts the positions of the limbs.
Spinal Cord:

**spinal cord** – a slender nerve column that passes downward from the brain into the vertebral canal

**spinal nerves** – branch out from the spinal cord

The center is filled with a fluid called **cerebrospinal fluid (CSF)**.
Signals are carried to the brain through ascending tracts and away from the brain through descending tracts.

CSF is continuously being filtered out of the blood. This happens in a network of brain capillaries called the choroids plexus.
This CSF fluid is always flowing from ventricle to ventricle and up and down the ascending and descending tracts.

If the flow gets stopped it can cause a condition called *hydrocephalus* or water on the brain. This is a very dangerous thing as it causes *pressure* on the brain.
Injuries to the spinal cord can cause two things to happen:

1) **anesthesia** – which is loss of sensation

2) **paralysis** – loss of ability to make voluntary movements

**Coverings of the Brian and Spinal Cord:**

The brain and spinal cord are protected by a layer called **meninges**.
There are three layers of the meninges:

1) **dura mater** – the tough, outer layer
2) **arachnoid mater** – netlike membrane
3) **pia mater** – bottom layer that contains blood vessels and nerves
There are 12 pairs of **cranial** nerves that branch off the brainstem and connect to things such as the eyes, nose, ears, tongue, heart, lungs and intestines.

There are 31 pairs of **spinal** nerves that branch off the spinal cord and connect to all the muscles and skin of the body.
Nerve Impulses:

The nerves transmit their signals through what is called a potential difference.

It is negatively charged inside and positively charged outside.

As an impulse travels down the nerve positive ions are quickly pumped inside which is called depolarization. Other positive ions are pumped back outside and this process is called repolarization.
In an unmyelinated fiber, a nerve impulse acts like a wave of this process moving down the dendrite or axon.

In a myelinated fiber, the nerve impulse jumps from one constriction to another down the axon.

A nerve impulse – is a wave of depolarization conducted along a nerve fiber.