Topic: HUMAN **PHYSIOLOGY**

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Peripheral Nervous System

The Cranial Nerves

There are twelve pairs of Cranial nerves which have their origin from various parts of the brain. Some are mixed nerves, i.e. both motor and sensory, some motor only, and some sensory nerves, e.g. the nerves
of the special senses. The cranial nerves are;

1. Olfactory - the nerve of smell.
2. Optic - the nerve of sight.
3. Oculo motor - the nerve of the external muscles of the eye
4. Trochlear- innervates one muscle of the eye-ball, the external Oblique.
5. Trigeminal -innervates most of the skin of the head and face; the membranes of the mouth, nose, teeth and the muscles for mastication.
6. Abducent -innervates the muscle of the eye-ball, the lateral rectus.
7. Facial - innervates the muscles of expression of the face.
8. Auditory or Acoustic (Vestibulocochlear) - the nerve of hearing.
9. Glossopharyngeal - innervates the constrictor muscle of the pharynx, parotid gland, tongue and the soft palate.
10. Vagus - innervates most of the organs on the thoracic and abdominal cavities.
11. Accessory - innervates muscles of the neck.
12. Hypoglossal - innervates the muscle of the tongue. Thus, the Cranial nerves do their functions in various parts of the body.

Spinal Nerves

There are 31 pairs of spinal nerves which are attached to the spinal cord by two roots. viz., the dorsal root and the ventral root. Each spinal nerve is formed by the union of anterior and posterior roots. Anterior root contains motor fibers and posterior root consists of sensory fibers. The larger anterior branches interlace to form networks called plexus which then give off branches to the various parts.

The three main plexuses are

1. The cervical plexus - muscles of the neck and back of the head.
2. The brachial plexus - shoulders, arm, forearm, the wrist and the hand.
3. The lumbosacral plexus - nerves to the lower extremities.

The Autonomic Nervous System

This nervous system controls the activity of viscera. Its actions are generally unconscious and independent of will. Hypothalamus, thalamus and cerebrum control this system. Based on the nature of function it is classified into Sympathetic and Parasympathetic. These two are functionally opposite. The former is catabolic in nature, while the latter is anabolic.

Sympathetic and Parasympathetic system

Sympathetic Nervous system prepares the body to deal with stressful and exciting

situations. It mobilizes the body for ‘fight’ or ‘flight’.

Parasympathetic Nervous system has a tendency to slow down body processes except digestion and absorption of food and functions of the genitourinary systems. It acts in general as a ‘peace maker’.

Table-1: Effects of Autonomic stimulation on the various body systems.

System	Sympathetic Stimulation	Parasympathetic stimulation
Cardiovascular System	Accelerates heart rate, raises blood pressure.	Heart rate is decreased.
Respiratory system	Dilation of bronchi allowing greater amount of air to enter lungs.	Constriction of bronchi.
Digestive system	Rate of digestion & absorption of food decreases.	Rate of digestion & absorption of food is increased.

Reflex action

Brain is like a very fine electronic computer receiving information from various sources, collecting and analysing it and giving appropriate stimuli for action. There are a large number of actions which do not require the intervention of the brain and can be executed at lower levels. Examples of this are heartbeat, respiratory movements and gastric secretions which are carried out automatically. Autonomous nervous system controls the above said activities. Apart from this there is a large group of activity, many of them voluntary in nature which are also done similarly. Examples are closing of the eyelids when light falls on it, removing the hand when it touches something hot, locking a knee joint to support the body when the other joint relaxes, coughing when the throat is irritated are all examples of related activity.
Most of the voluntary activities are reflex in nature and these are the most elementary type of nervous activity.

Example of Reflex Action

Knee jerk. When the patellar tendon is tapped by a knee hammer there is a sudden unconscious tensing of the thigh muscles resulting in an upward movement of the leg.A reflex action requires the following structures:

1. A sensory organ which receives the stimuli, e.g. the skin.

2. A sensory nerve fibre which conducts this impulse to the cells of the spinal cord.
3. Spinal Cord - where connector nerves pass impulses on to the anterior horn of the cord.
4. A motor nerve cell which receives and transmits the impulse along the motor nerve fibres.
5. A motor organ e.g., a muscle, which performs the action, when stimulated by the motor nerve impulse

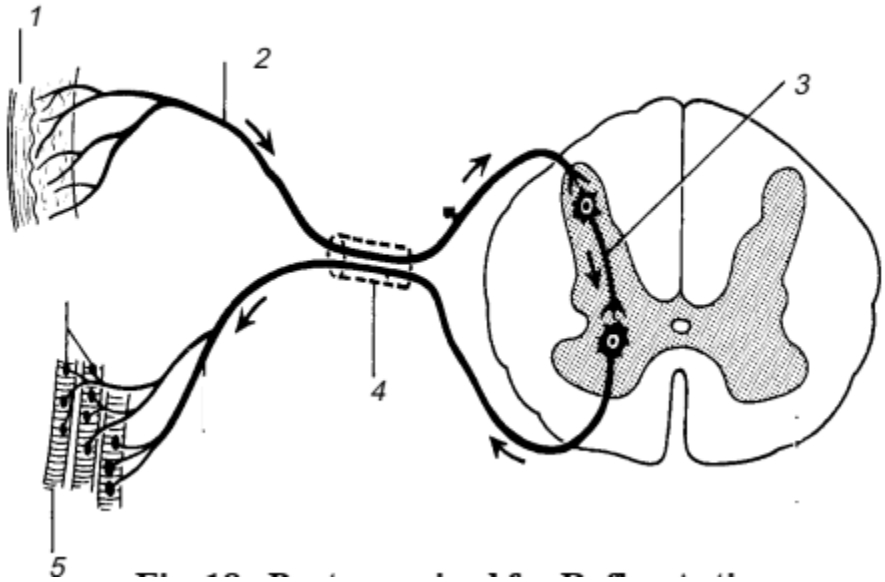

Fig. 1 - Parts required for Reflex Action

1. Sensory organ
2. Sensory nerve fibre
3. Connector nerve
4. Motor nerve fibre
5. Motor organ

Reflex action can be divided into conditioned reflex and unconditioned reflex.

Conditioned Reflex

This type of reflex is developed only with experience. A new born child will not secrete saliva if food is shown or if it smells food. On the other hand, an adult will salivate on the sight or smell of food because of the association of the special senses with food. These types of reflexes are called **Conditioned reflexes.** Conditioned reflexes were first demonstrated by **Pavlov**, a Russian Physiologist. He conducted his experiment with a dog which salivated at the sight of the food. Then the stimulus i.e., food was associated with the ringing of the bell. The animal was fed a number of times immediately after the ringing of the bell. Then the original stimulus (food) was withdrawn and mere ringing of the bell produced salivation. This is referred to as 'Conditioned Reflex'

Unconditioned Reflex

These actions are carried out entirely through centres situated in the spinal cord or lower levels of the brain. Unconditioned reflexes are

inborn and habitual. They are not dependant on past experience, education or training. For example, while walking, the flexors of the leg contract simultaneously and the extensors relax simultaneously. When the leg is stretched these two activities namely the contraction and relaxation occur vice versa.