

Diagram 2(i): Structure of the Neuron

Generally speaking, we can divide the nervous system into different parts, according to location and function. So far we have mentioned the *central nervous system (CNS)* - constituting the brain and the spinal cord - which receives and organizes information received from the peripheral nervous system (PNS). The central nervous system is also responsible for transforming and storing information, and transmitting messages back to the peripheral system. The *peripheral nervous system (PNS)* functions as a communication channel between the CNS and the external world.

In part, the PNS consists of fibres of sensory and motor, neurons. The sensory or afferent fibres run from sense organs INTO the CNS; the motor, or efferent fibres run OUT from the CNS to excite muscles or glands, (Morgan and King, 1971)

THE PERIPHERAL NERVOUS SYSTEM

The peripheral nervous system can be divided into two different parts according to function: the *somatic system* and the *autonomic system*.

The sensory nerves of the somatic system carry information regarding external stimulation of the skin, muscles and joints to the CNS. Such information might concern temperature, pressure or pain. The motor nerves of the somatic system carry impulses from the CNS to the external components of the body, for instance, involuntary muscles involved in posture correction and mainly muscles involved in voluntary movement and action.

The autonomic nervous system, on the other hand, is involved in the relay of messages to and from the CNS concerning the activities of the internal organs, for example, breathing, heart-rate, digestion, and glands. The autonomic system has two patterns of action which can roughly be described as a tension pattern (sympathetic) and a relaxation pattern (parasympathetic).

The *sympathetic* division increases heart-rate, dilates the arteries of the heart and muscles, constricts the arteries of the skin (causing perspiration), constricts the digestive organs.

The *parasympathetic* division constricts the pupil of the eye, slows the heart rate, relaxes the muscles, increases the flow of saliva and other digestive juices.

When you are in a heightened state of fear, for instance, walking down a dark alley at night, the sympathetic pattern initiates an increase in the rate of heartbeat and the production of adrenalin. As a result, you might run faster, than you knew you could.

When a haven of safety and security replaces this state, the parasympathetic pattern reinstates the balance by reducing the heart-rate and producing a state of relaxation. Now that you are relaxed, your appetite will return - you might have some toast and tea to replenish the energy used up during the tense stage.

PERSONAL EXERCISE 2(a)

1. Write a detailed account of your activities between waking up and starting work. Now list every physical activity you have mentioned. Next to each activity on the list name one or two parts of the nervous system that were centrally involved.

For some activities you probably cannot identify a particular part of the nervous system. If so, wait until you have completed this lesson and then return to the exercise.

Example:

Make a cup of tea: The brain and motor nerves of the somatic nervous system.

Drink the cup of tea: The parasympathetic division of the autonomic nervous system, and the sensory nerves of the somatic division.

CENTRAL NERVOUS SYSTEM

The Spinal Cord

Messages from all over the body (except the face and neck) are transmitted to and from the brain via the pathways of neurons in the spinal cord. *Motor pathways* descend and transmit messages from the brain to the muscles and glands.

Sensory pathways ascend and transmit sensory information from the muscles and glands about:

- position of the limbs; tension or relaxation in the muscles
- body temperature; sensations of heat or cold
- pain; pressure; touch

The Brain

Since we are not concerned with detailed physiology, getting an in depth knowledge of the highly complex structure of the brain is not necessary. However, a general understanding of the basic parts of the brain is useful when seen in relation to their psychological functions - their effect on our behaviour.

The brain is made up of three basic concentric layers: a primitive central core, the limbic system in the middle and the outer layer called the cerebrum. However, these parts are integrated in a complex fashion and cannot therefore be treated in isolation. The major parts of the brain forming these layers are named and described below. The physiological or psychological function of the part follows each description.

THE CENTRAL CORE OF THE BRAIN

The central core consists of most of the brain stem. The end of the spinal cord, as it enters the base of the skull is enlarged. This enlargement is called the *medulla oblongata*.

Function: controls respiration and some reflexes (especially those which maintain the body's upright position).

The *cerebellum* is also part of the central core. (Do not confuse it with the cerebrum which is the outer layer.) It is a convoluted structure situated behind the medulla oblongata.

Function: Coordination of movement.

Thalamus and Hypothalamus. These are two groups of concentrated nerve cell nuclei. They are situated above the medulla and within the centre of the cerebral layer. Both have an oval shaped structure. The hypothalamus is the smaller of the two and is situated beneath the thalamus. The thalamus has a twofold function:

1. It acts as a channel between the sense receptors (all except smell) and the cerebrum.
2. It plays a role in controlling the cycle of sleep and wakefulness.

The function of the hypothalamus is to control:

1. Patterns of eating, drinking and sexual behaviour.
2. Homeostasis, i.e. the maintenance of a healthy balance of temperature, heart-rate and blood pressure.
3. Hormonal activity.

The *reticular system* is a network of neural pathways throughout the central core. It is connected to all the sense receptors.

Function: It acts as a filter or sieve for all incoming information and thus plays a role in our attention, awareness and arousal.

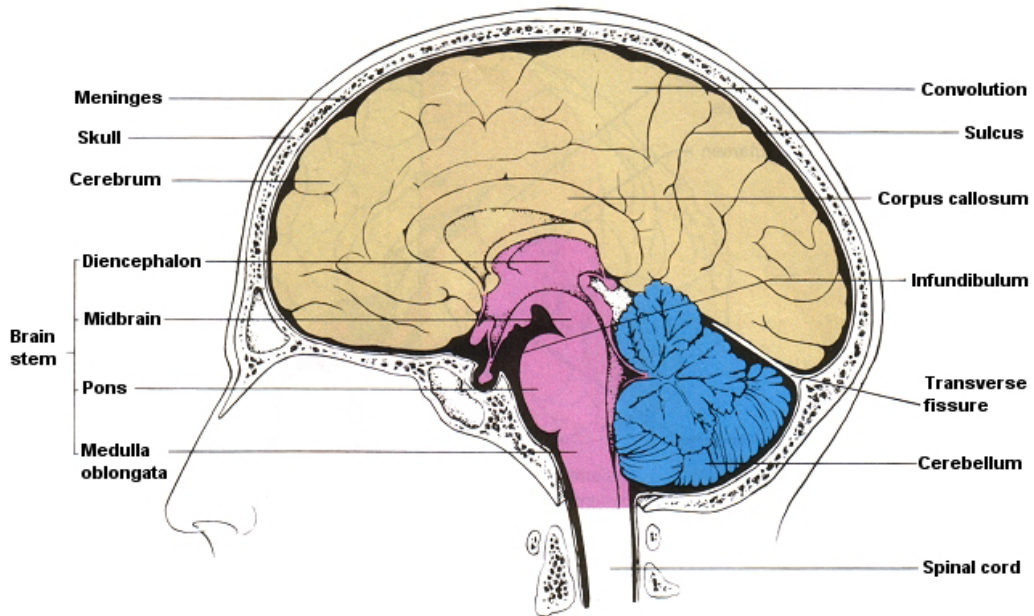


Diagram 2(ii): The Brain

The *limbic system* is a composite of structures which surround the central core.

Function:

1. It acts as the seat of our drives and emotions.
2. It also aids the hypothalamus in curbing instinctive drives.
3. Part of the system is also involved with memory capacity.

The *cerebrum* consists of two cerebral *hemispheres* and the cerebral cortex - a convoluted layer which covers the entire structure. The *cerebral cortex* is the seat of higher mental processes such as planning and decision-making.

In all, the function of the cortex involves:

1. Receiving complex sensory information
2. Controlling the body's motor movements
3. The main bulk of the cortex, however, is involved not with the motor and sensory functions, but with *complex human* activities such as *memory, language and thought*