

Topic Page: [Human brain](#)

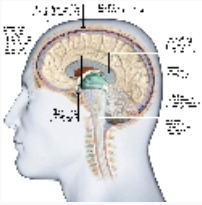


Image from: [Brain structures A section down the middle of the... in The Human Body Book: An Illustrated Guide to Its Structure, Function and Disorders](#)

Summary Article: **Brain**

From *Black's Medical Dictionary, 43rd Edition*

The brain and spinal cord together form the central nervous system (CNS). Twelve cranial nerves leave each side of the brain (see **NERVES**, below) and 31 spinal nerves from each side of the cord: together these nerves form the peripheral nervous system. Complex chains of nerves lying within the chest and abdomen, and acting largely independently of the peripheral system, though linked with it, comprise the **AUTONOMIC SYSTEM** and govern the activities of the **VISCERA**.

The control centre of the whole nervous system is the brain, which is located in the skull or cranium. As well as controlling the nervous system it is the organ of thought, speech and emotion. The central nervous system controls the body's essential functions such as breathing, body temperature (see **HOMEOSTASIS**) and the heartbeat. The body's various sensations, including sight, hearing, touch, pain, positioning and taste, are communicated to the CNS by nerves distributed throughout the relevant tissues. This information is then sorted and interpreted by specialised areas in the brain. In response these initiate and coordinate the motor output, triggering such 'voluntary' activities as movement, speech, eating and swallowing. Other activities – for example, breathing, digestion, heart contractions, maintenance of **BLOOD PRESSURE**, and filtration of waste products from blood passing through the kidneys – are subject to involuntary control via the autonomic system. There is, however, some overlap between voluntary and involuntary controls.

Divisions

Cerebrum

This forms nearly 70 per cent of the brain and consists of two cerebral hemispheres which occupy the entire vault of the cranium and are incompletely separated from one another by a deep midline cleft, the longitudinal cerebral fissure. At the bottom of this cleft the two hemispheres are united by a thick band of some 200 million crossing nerve fibres – the corpus callosum. The cerebrum is divided into lobes; the frontal lobe in the forehead region, the parietal lobe on the side and upper part of the brain, the occipital lobe to the back, and the temporal lobe lying just above the region of the ear. The outer 3 mm of the cerebrum is called the cortex, which consists of grey matter containing nerve cells arranged in six layers. This region is concerned with conscious thought, sensation and movement.

Infoldings of the surface, called sulci, separate raised areas called gyri. In the deeper part lies the white matter, consisting of nerve fibres connecting different parts of the surface and passing down to the lower parts of the brain. Among the white matter are several rounded masses of grey matter, the lentiform and caudate nuclei. In the centre of each cerebral hemisphere is an irregular cavity, the lateral ventricle, which communicates with that on the other side and behind with the third ventricle through a small opening, the inter-ventricular foramen, or foramen of Monro.

Basal nuclei

Two large masses of grey matter embedded in the base of the cerebral hemispheres in humans, but

forming the chief part of the brain in many animals. Between these masses lies the third ventricle, from which the infundibulum, a funnel-shaped process, projects downwards into the pituitary body. This region includes the important HYPOTHALAMUS.

Mid-brain

or mesencephalon: a stalk about 20 mm long connecting the cerebrum with the hind-brain. Down its centre lies a tube, the cerebral aqueduct, or aqueduct of Sylvius, connecting the third and fourth ventricles. Above this aqueduct lie the corpora quadrigemina, and beneath it are the crura cerebri, strong bands of white matter in which important nerve fibres pass downwards from the cerebrum. The PINEAL GLAND is sited on the upper part of the mid-brain.

Pons

A mass of nerve fibres, some of which run crosswise and others are the continuation of the crura cerebri downwards.

Cerebellum

This lies towards the back, underneath the occipital lobes of the cerebrum.

Medulla oblongata

The lowest part of the brain, in structure resembling the spinal cord, with white matter on the surface and grey matter in its interior. This is continuous through the large opening in the skull, the foramen magnum, with the spinal cord. Between the medulla, pons, and cerebellum lies the fourth ventricle of the brain.

Structure

The grey matter consists mainly of billions of nerve cells (see NEURON(E)) in which all the activities of the brain begin. These cells vary considerably in size and shape, though all give off a number of processes, some of which form nerve fibres. The grey matter is everywhere penetrated by a rich supply of blood vessels, and the nerve cells and blood vessels are supported in a fine network of fibres known as neuroglia.

The white matter consists of nerve fibres, each of which is attached, at one end, to a cell in the grey matter, while distally it splits up into a tree-like structure around another cell in another part of the grey matter in the brain or spinal cord. The fibres have insulating sheaths of a fatty material which gives the white matter its colour; the fibres convey messages from one part of the brain to the other (association fibres), or, grouped into bundles, leave the brain as nerves, or pass down into the spinal cord where they end near, and exert a control upon, cells from which in turn spring the nerves to the body.

Both grey and white matter are bound together by a network of cells called GLIA which make up 60 per cent of the brain's weight. Research points to the likelihood that glial cells are as complex as neurons, functioning biochemically in a similar way. Glial cells also absorb potassium pumped out by active neurons, and prevent levels of GLUTAMATE – the most common chemical messenger in the brain – from becoming too high.

The general arrangement of fibres can be best understood by describing the course of a motor nerve-fibre. Arising in a cell on the surface in front of the central sulcus, such a fibre passes inwards towards

the centre of the cerebral hemisphere, down through the crus cerebri, giving off various small connecting fibres. After passing through the pons it reaches the medulla, and at this point crosses to the opposite side (decussation of the pyramids). Entering the spinal cord, it passes downwards to end finally in a series of branches (arborisation) which meet and touch (synapse) similar branches from one or more of the cells in the grey matter of the cord (see SPINAL CORD).

Blood vessels

Four vessels carry blood to the brain: two internal carotid arteries in front, and two vertebral arteries behind. These communicate to form a circle (circle of Willis) inside the skull, so that if one is blocked, the others, by dilating, take its place. The chief branch of the internal carotid artery on each side is the middle cerebral, and this gives off a small but very important branch which pierces the base of the brain and supplies the region of the internal capsule with blood. The chief importance of this vessel lies in the fact that the blood in it is under especially high pressure, owing to its close connection with the carotid artery, so that haemorrhage from it is liable to occur and thus give rise to stroke. Two veins, the internal cerebral veins, bring the blood away from the interior of the brain, but most of the small veins come to the surface and open into large venous sinuses, which run in grooves in the skull, and finally pass their blood into the internal jugular vein that accompanies the carotid artery on each side of the neck.

Membranes

The brain is separated from the skull by three membranes: the dura mater, a thick fibrous membrane; the arachnoid mater, a more delicate structure; and the pia mater, adhering to the surface of the brain and containing the blood vessels which nourish it. Between each pair is a space containing fluid on which the brain floats as on a water-bed. The fluid beneath the arachnoid membrane mixes with that inside the ventricles through a small opening in the fourth ventricle, called the median aperture, or foramen of Magendie.

These fluid arrangements have a great influence in preserving the brain from injury.

Nerves

Twelve nerves come off the brain:

1. Olfactory, to the nose (smell).
2. Optic, to the eye (sight).
3. Oculomotor to eye muscles
4. Trochlear, to eye-muscles.
5. Trigeminal, to skin of face.
6. Abducent, to eye-muscles.
7. Facial, to muscles of face.
8. Vestibulocochlear, to ear (hearing and balancing).
9. Glossopharyngeal, to tongue (taste).
10. Vagus, to heart, larynx, lungs, and stomach.

11. Spinal accessory, to muscles in neck.

12. Hypoglossal, to muscles of tongue.

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Chicago

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"Brain." *Black's Medical Dictionary, 43rd Edition*, edited by Harvey Marcovitch, A&C Black, 43rd edition, 2018. *Credo Reference*, https://search.credoreference.com/content/topic/human_brain. Accessed 14 Nov. 2019.