Lecture 5 The Brain second stage

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The brain is that part of the central nervous system that lies inside the cranial cavity. It is continuous with the spinal cord through the foramen magnum.

Major Parts of the Brain		Cavities of the Brain
Forebrain	Cerebrum	Right and left lateral ventricles
	Diencephalon	Third ventricle
Midbrain		Cerebral aqueduct
Hindbrain	Pons	Fourth ventricle
	Medullaoblongata	and central canal
	Cerebellum	

Cerebrum

The **cerebrum** is the largest part of the brain and consists of two **cerebral hemispheres** connected by a mass of white matter called the **corpus callosum**.

Each hemisphere extends from the frontal to the occipital bones; above the anterior and middle cranial fossae; and, posteriorly, above the tentorium cerebelli. The hemispheres are separated by a deep cleft, the **longitudinal fissure**, into which projects the **falx cerebri**.

The surface layer of each hemisphere is called the **cortex** and is composed of **gray matter**. The cerebral cortex is thrown into folds, or **gyri,** separated by fissures, **or sulci.** By this means, the surface area of the cortex is greatly increased. Several of the large sulci conveniently subdivide the surface of each hemisphere into **lobes.** The lobes are named for the bones of the cranium under which they lie.

The **frontal lobe** is situated in front of the **central sulcus** and above the **lateral sulcus.** The **parietal lobe** is situated behind the central sulcus and above the lateral sulcus. The **occipital lobe** lies below the **parietooccipital sulcus.** Below the lateral sulcus is situated the **temporal lobe.**

The **precentral gyrus** lies immediately anterior to the central sulcus and is known as the **motor area**. The large motor nerve cells in this area control voluntary movements on the opposite side of the body. Most nerve fibers cross over to the opposite side in the medulla oblongata as they descend to the spinal cord.

In the motor area, the body is represented in an inverted position, with the nerve cells controlling the movements of the feet located in the upper part and those controlling the movements of the face and hands in the lower part.

The **postcentral gyrus** lies immediately posterior to the central sulcus and is known as the **sensory area**. The small nerve cells in this area receive and interpret

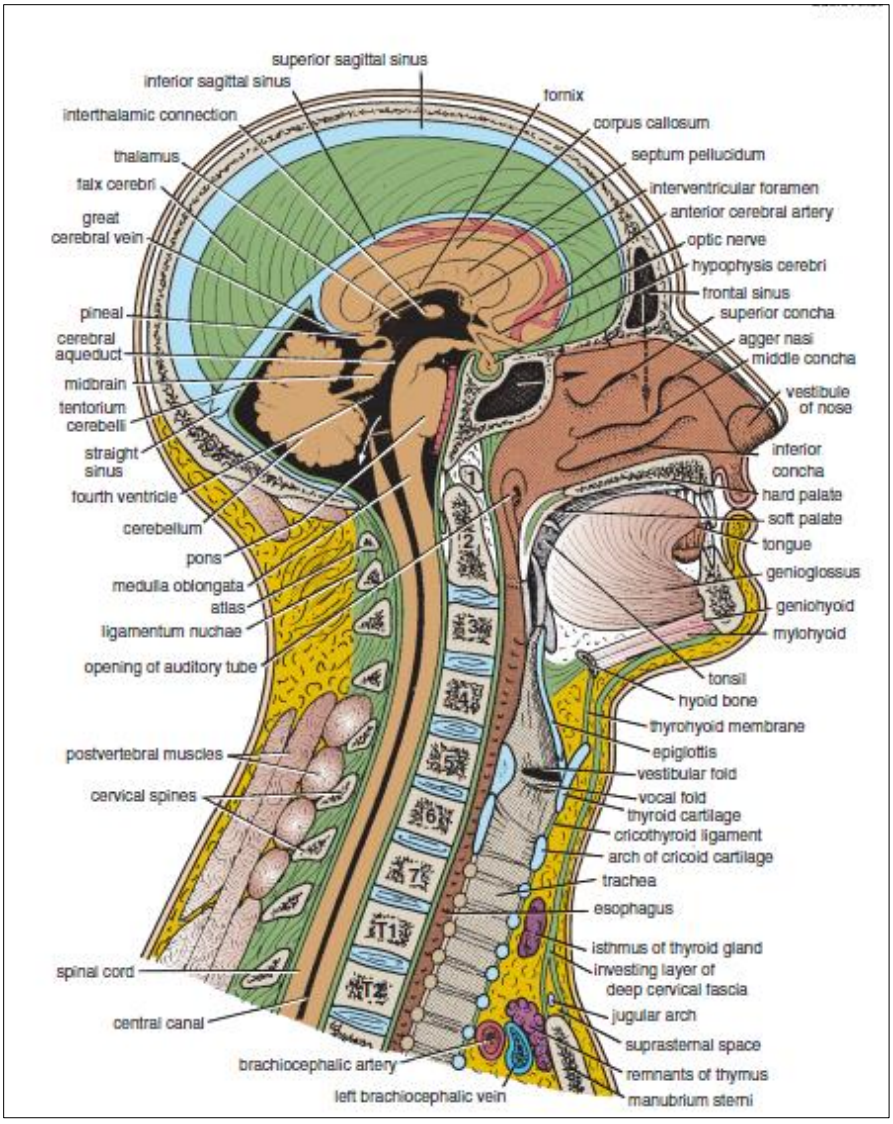
sensations of pain, temperature, touch, and pressure from the opposite side of the body.

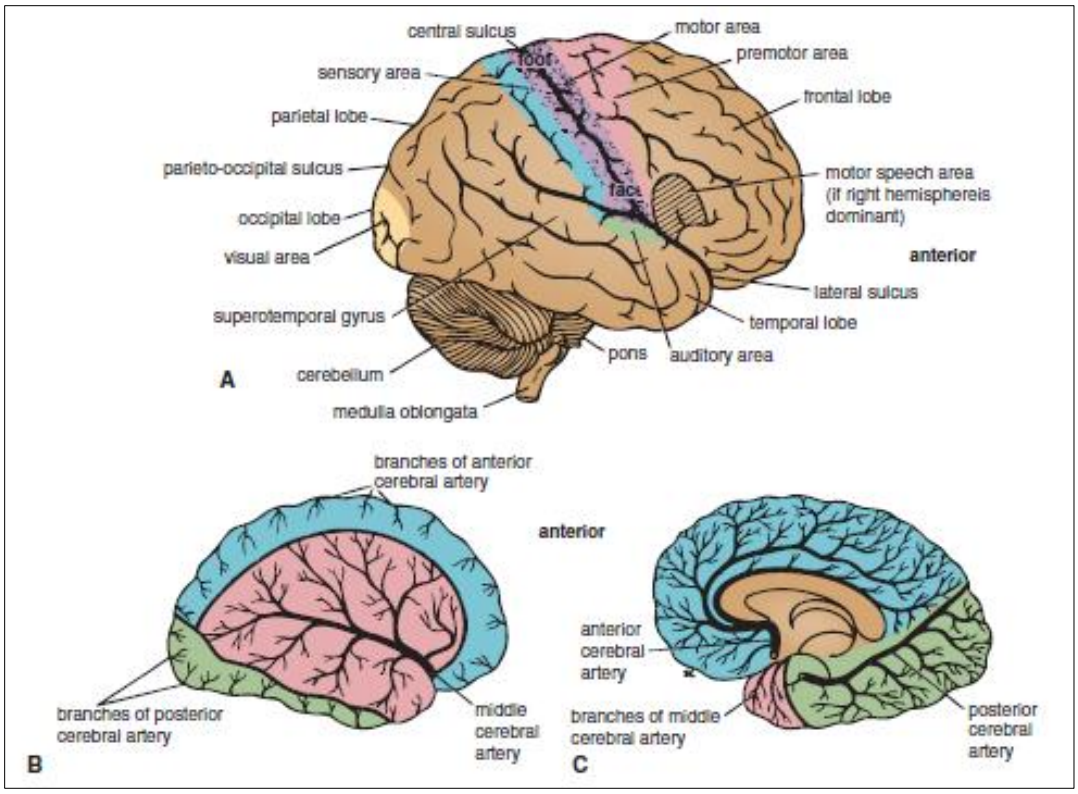
The **superior temporal gyrus** lies immediately below the lateral sulcus. The middle of this gyrus is concerned with the reception and interpretation of sound and is known as the **auditory area.**

Broca's area, or the **motor speech area,** lies just above the lateral sulcus. It controls the movements employed in speech. It is dominant in the left hemisphere in right-handed persons and in the right hemisphere in left-handed persons.

The **visual area** is situated on the posterior pole and medial aspect of the cerebral hemisphere in the region of the **calcarine sulcus**. It is the receiving area for visual impressions.

The cavity present within each cerebral hemisphere is called the **lateral ventricle.** The lateral ventricle communicate with the third ventricle through the **interventricular foramina.**





Diencephalon

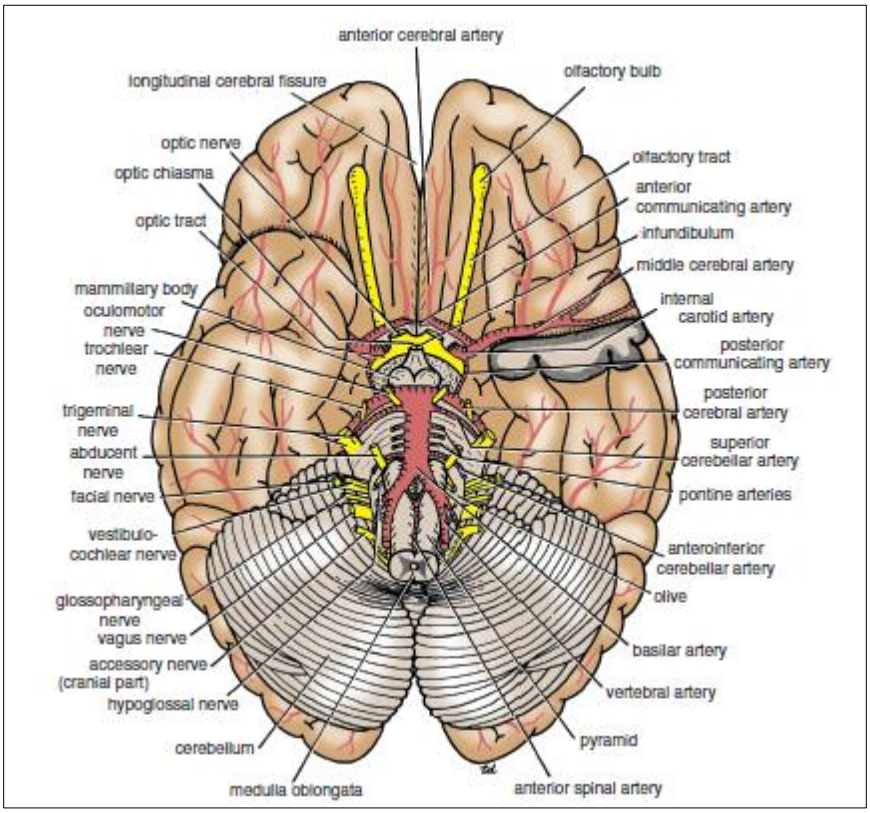
The diencephalon is almost completely hidden from the surface of the brain. It consists of a dorsal **thalamus** and a ventral **hypothalamus.** The thalamus is a large mass of gray matter that lies on either side of the third ventricle. It is the great relay station on the afferent sensory pathway to the cerebral cortex. The hypothalamus forms the lower part of the lateral wall and floor of the third ventricle. The following structures are found in the floor of the third ventricle from before backward: the **optic chiasma**, the **tuber cinereum** and the **infundibulum,** the **mammillary bodies,** and the **posterior perforated substance.**

Midbrain

The midbrain is the narrow part of the brain that passes through the tentorial notch and connects the forebrain to the hindbrain.

The midbrain comprises two lateral halves called the **cerebral peduncles;** each of these is divided into an anterior part, the **crus cerebri;** and a posterior part, the **tegmentum,** by a pigmented band of gray matter, the **substantia nigra**. The narrow cavity of the midbrain is the **cerebral aqueduct,** which connects the third and fourth ventricles. The **tectum** is the part of the midbrain posterior to the cerebral aqueduct; it has four small surface swellings, namely, the **two superior** and **two inferior colliculi.**

The colliculi are deeply placed between the cerebellum and the cerebral hemispheres. The **pineal body** is a small glandular structure that lies between the superior colliculi. It is attached by a stalk to the region of the posterior wall of the third ventricle. The pineal commonly calcifies in middle age, and thus it can be visualized on radiographs.



Hindbrain

The **pons** is situated on the anterior surface of the cerebellum below the midbrain and above the medulla oblongata. It is composed mainly of nerve fibers, which connect the two halves of the cerebellum. It also contains ascending and descending fibers connecting the forebrain, the midbrain, and the spinal cord. Some of the nerve cells within the pons serve as relay stations, whereas others form cranial nerve nuclei.

The **medulla oblongata** is conical in shape and connects the pons above to the spinal cord below. A **median fissure** is present on the anterior surface of the medulla, and on each side of this is a swelling called the **pyramid**. The pyramids are composed of bundles of nerve fibers that originate in large nerve cells in the precentral gyrus of the cerebral cortex. The pyramids taper below, and here most of the descending fibers cross over to the opposite side, forming the **decussation of the pyramids.**

Posterior to the pyramids are the **olives,** which are oval elevations produced by the underlying **olivary nuclei**. Behind the olives are the **inferior cerebellar peduncles,** which connect the medulla to the cerebellum.
On the posterior surface of the inferior part of the medulla oblongata are the **gracile** and **cuneate tubercles,** produced by the medially placed underlying **nucleus gracilis** and the laterally placed underlying **nucleus cuneatus.**
The **cerebellum** lies within the posterior cranial fossa beneath the tentorium cerebelli. It is situated posterior to the pons and the medulla oblongata. It consists of two hemispheres connected by a median portion, the **vermis.** The cerebellum is connected to the midbrain by the **superior cerebellar peduncles,** to the pons by the **middle cerebellar peduncles,** and to the medulla by the **inferior cerebellar peduncles.**
The surface layer of each cerebellar hemisphere, called the **cortex,** is composed of gray matter. The cerebellar cortex is thrown into folds, or **folia,** separated by closely set transverse fissures. Certain masses of gray matter are found in the interior of the cerebellum, embedded in the white matter; the largest of these is known as the **dentate nucleus.**
The cerebellum plays an important role in the control of muscle tone and the coordination of muscle movement on the same side of the body.
The cavity of the hindbrain is the fourth ventricle. This is bounded in front by the pons and the medulla oblongata and behind by the **superior** and **inferior medullary vela** and the cerebellum. The fourth ventricle is connected above to the third ventricle by the cerebral aqueduct, and below it is continuous with the central canal of the spinal cord. It communicates with the subarachnoid space through three openings in the lower part of the roof: a median and two lateral openings.

Ventricles of the Brain

The ventricles of the brain consist of the two lateral ventricles, the third ventricle, and the fourth ventricle. The two **lateral ventricles** communicate with the **third ventricle** through the **interventricular foramina**; the third ventricle communicates with the fourth ventricle by the **cerebral aqueduct.** The fourth ventricle, in turn, is continuous with the narrow **central canal** of the spinal cord and, through the three foramina in its roof, with the subarachnoid space. The ventricles are filled with cerebrospinal fluid, which is produced by the **choroid plexuses** of the two lateral ventricles, the third ventricle, and the fourth ventricle. The size and shape of the cerebral ventricles may be visualized clinically using computed tomography (CT) scans and magnetic resonance imaging (MRI).

Blood Supply of the Brain

Arteries of the Brain

The brain is supplied by the two internal carotid and the two vertebral arteries. The four arteries anastomose on the inferior surface of the brain and form the **circle of Willis** (circulus arteriosus).

Veins of the Brain

The veins of the brain have no muscular tissue in their thin walls, and they possess no valves. They emerge from the brain and drain into the cranial venous sinuses.
Cerebral and cerebellar veins and veins of the brainstem are present. The **great cerebral vein** is formed by the union of the two **internal cerebral veins** and drains into the straight sinus.

The Cranial Nerves in the Cranial Cavity

The 12 pairs of cranial nerves are named as follows:
I. Olfactory (sensory)
II. Optic (sensory)
III. Oculomotor (motor)
IV. Trochlear (motor)
V. Trigeminal (mixed)
VI. Abducent (motor)
VII. Facial (mixed)
VIII. Vestibulocochlear (sensory)
IX. Glossopharyngeal (mixed)
X. Vagus (mixed)
XI. Accessory (motor)
XII. Hypoglossal (motor)

The nerves emerge from the brain and are transmitted through foramina and fissures in the base of the skull. All the nerves are distributed in the head and neck except the vagus, which also supplies structures in the thorax and abdomen. The olfactory, optic, and vestibulocochlear nerves are entirely sensory; the oculomotor, trochlear, abducent, accessory, and hypoglossal nerves are entirely motor; and the remaining nerves are mixed.

References :

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2- Norton, Neil S. Netter's head and neck anatomy for dentistry e-book. Elsevier Health Sciences, 2016.