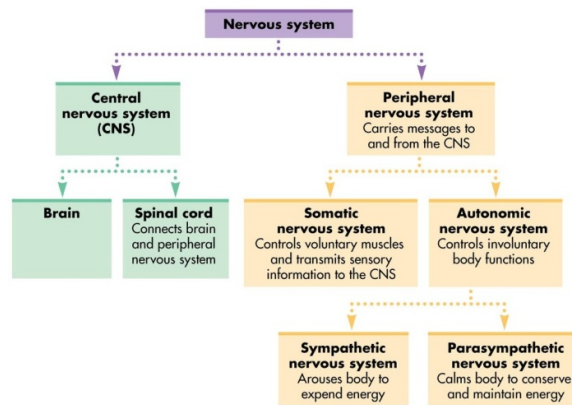


THE HUMAN NERVOUS SYSTEM

The Human Nervous System plays a vital role in regulating and coordinating all physical activities as well as psychological processes such as thinking, learning, memory, emotions, and behavior. In psychology, the nervous system is important because it helps explain how biological processes influence human behaviour.

The nervous system is mainly divided into two major parts: the Central Nervous System and the Peripheral Nervous System. Together, these systems enable individuals to perceive the world, respond to stimuli, and maintain internal balance.

FIGURE 1



Central Nervous System:

The Central Nervous System (CNS) is the most vital part of the human nervous system and functions as the control center of the body. It receives information from different parts of the body, processes that information, and sends appropriate responses.

The Central Nervous System mainly consists of two major parts:

1. **The Brain:** Responsible for higher mental functions such as thinking, learning, memory, emotions, and decision-making.
2. **Spinal Cord:** Acts as a communicator between the brain and the rest of the body, transmitting sensory information to the brain and motor commands back to the

muscles and organs (Carlson & Birkett, 2021). It also controls certain automatic responses known as reflex actions.

Understanding the Central Nervous System is very important in psychology because it helps to understand how brain structures influence behaviour, cognition, emotions, and various physiological processes.

The Brain:

The human brain is probably the most complex structure in the known universe. The human brain is the centre of the human nervous system and is a highly complex organ. There are estimated to be as many as 100 billion neurons in our nervous system. Enclosed in the cranium, brain has the same general structure as the brains of other mammals, but is over three times as large as the brain of a typical mammal with an equivalent body size.(IGNOU *Unit-2 The Brain*, 2017)

Figure 2

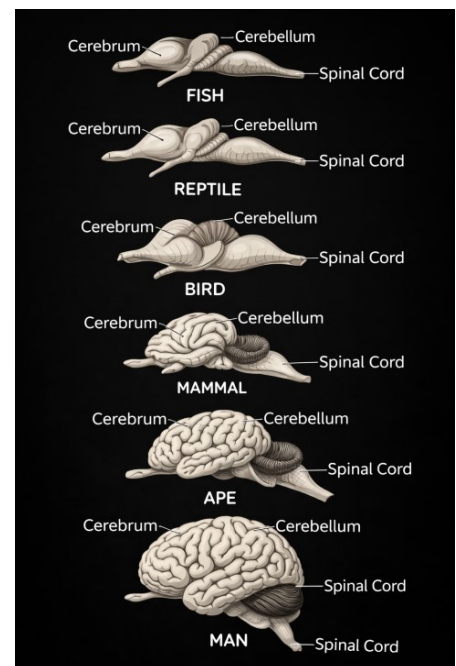
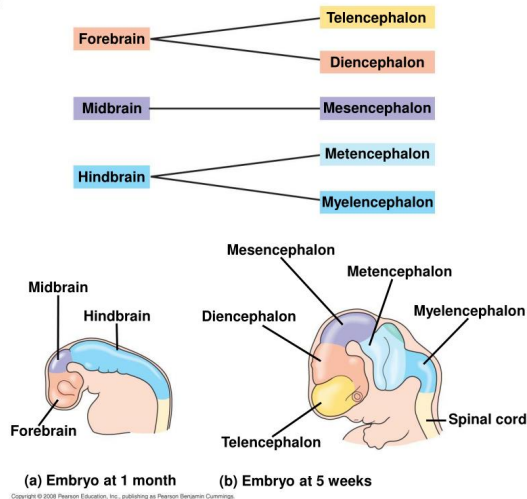


Table 1

MAJOR DIVISION AND FUNCTION OF BRAIN				
ADULT BRAIN DIVISION	DEVELOPMENTAL DIVISION (CEPHALON)		DEVELOPS INTO	MAIN FUNCTION
Forebrain	<i>Telencephalon</i>	Fig. 49-5b Forebrain → Telencephalon, Di-cephalon Midbrain → Mesencephalon Hindbrain → Metencephalon, Myelencephalon (a) Embryo at 1 month (b) Embryo at 5 weeks Copyright © 2010 Pearson Education, Inc. All Rights Reserved. Pearson Education, Inc.	Cerebrum	Thinking, memory, intelligence, voluntary movement
			Limbic system	emotion, memory, and motivation
			Basal ganglia	voluntary movement, cognition, emotion, and habit formation.
	<i>Diencephalon</i>		Thalamus, Hypothalamus	Sensory relay, body regulation
Midbrain	<i>Mesencephalon</i>		Midbrain	Visual and auditory reflexes
Hindbrain	<i>Metencephalon</i>		Pons and Cerebellum	Balance, coordination, sleep
	<i>Myelencephalon</i>		Medulla Oblongata	Breathing, heartbeat, blood pressure

Fig. 49-9ab



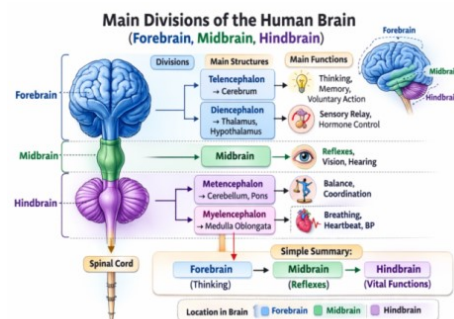
For convenience of study brain can be divided into three parts

1. Forebrain
2. Midbrain
3. Hindbrain

1. Forebrain: In short Forebrain = Telencephalon + Diencephalon

Figure 3

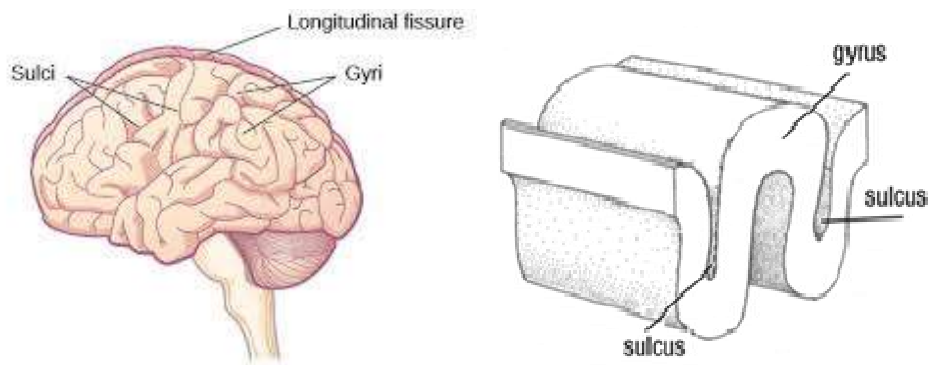
Telencephalon: The larger part of the brain is telencephalon, mainly the Cerebrum is called Telencephalon its main Functions are Thinking and intelligence, Memory and learning, Voluntary movements, Sensory perception (touch, vision, hearing, taste, smell), Emotions and behaviour



Cerebrum:

Bumps and grooves of the brain: In humans, the lobes of the brain are divided by a number of bumps and grooves. These are known as gyri (bumps) and sulci (groves or fissures). The folding of the brain, and the resulting gyri and sulci, increases its surface area and enables more cerebral cortex matter to fit inside the skull. (*Lobes of the Brain*, 2016).

Figure 4



Fissure of the brain: A fissure of the brain is a deep groove or furrow on the surface of the cerebral cortex. While the brain is covered in many folds, fissures are specifically the deepest and most prominent of these grooves, primarily serving to divide the brain into its major lobes and hemispheres.

Major Fissures of the brain:

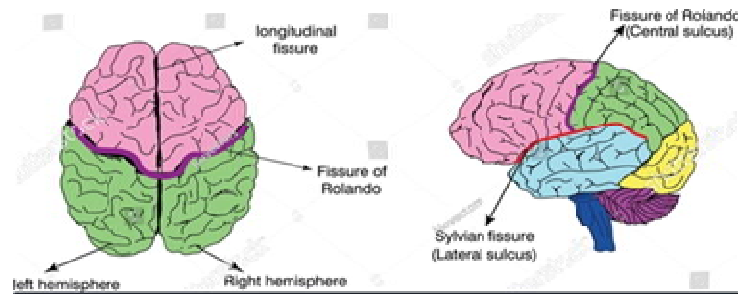
The brain has several major fissures that act as Anatomical and Functional Boundaries those are:

Longitudinal Fissure: The most prominent groove, it runs down the midline and splits the brain into the left and right cerebral hemispheres.

Lateral Fissure (Sylvian Fissure): A deep, complex fold that separates the temporal lobe from the frontal and parietal lobes above it.

Central Fissure (Fissure of Rolando): Often called the central sulcus, it separates the frontal lobe from the parietal lobe and is the border between the brain's primary motor and sensory regions.

Figure 5



(Brain Fissure Diagram Sylvian Rolandolongitudinal Sulcus Stock Vector (Royalty Free) 2113294106, n.d.)

Figure 6

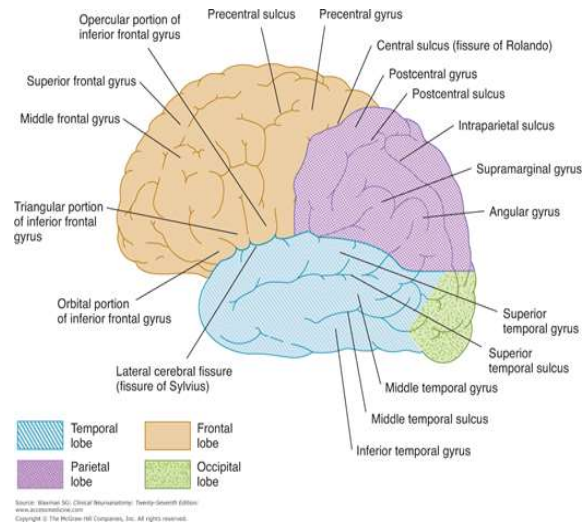


Image Source:

(Cerebral Hemispheres/Telencephalon | Neopsy Key, n.d.; Lobes of the Brain, 2016)

Transverse Fissure: A horizontal cleft that divides the cerebrum from the cerebellum

Parieto-occipital Fissure: Delineates the boundary between the parietal and occipital lobes.

Fissure vs. Sulcus

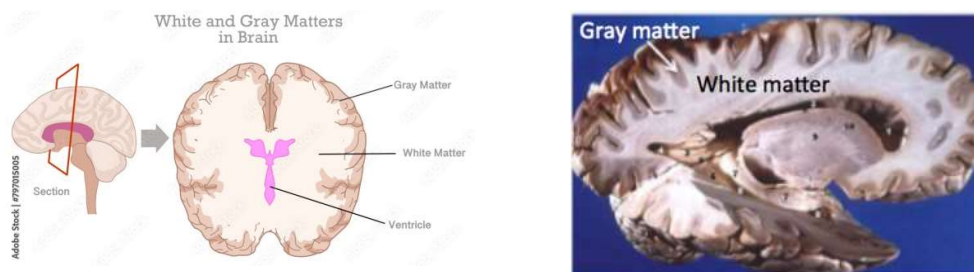
While both are grooves in the brain, they differ in size and function:

Fissures are deeper furrows that divide the brain into lobes or hemispheres.

Sulci (singular: sulcus): are shallower grooves that separate the smaller, raised ridges called gyri. They primarily serve to increase the brain's surface area for more neurons.

White and gray Matters: Gray matter and white matter are two important components of the central nervous system. Gray matter mainly consists of neuron cell bodies, dendrites, and synapses, and it is responsible for processing and interpreting information such as thinking, memory, and decision-making. In contrast, white matter is composed of myelinated axons, which form pathways that transmit nerve signals between different parts of the brain and spinal cord. Thus, while gray matter acts as the processing center, white matter functions as the communication network of the nervous system.

Figure 7



Lobes of the Cerebrum: The cerebral cortex is divided into four areas or lobes

1. The frontal lobe: Include everything in front of the central sulcus.
2. The parietal lobe: The parietal lobe is located on the side of the cerebral hemisphere, just behind the central sulcus, back to the frontal lobe.
3. The temporal lobe:(the temple) just forward from the base of the brain , ventral to the frontal and parietal lobes
4. The occipital lobe: The occipital lobe lies at the very back of the brain, back to the parietal and temporal lobes.

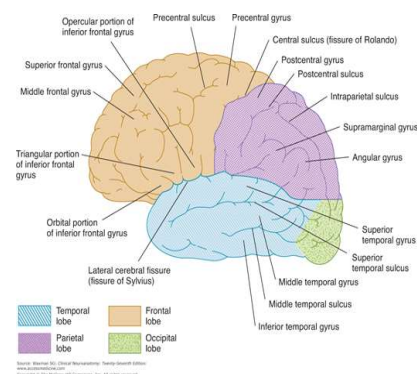


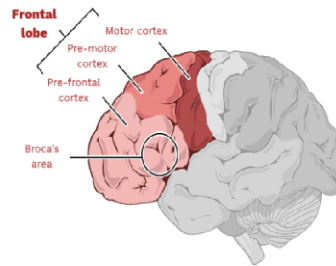
Image Source:
(Cerebral Hemispheres/Telencephalon | Neopsy Key, n.d.; Lobes of the Brain, 2016)

1. Key functions of the frontal lobe include: The frontal lobe is one of five lobes of human brain. This section of human brain works cooperatively with many other brain areas, giving a wide range of abilities.(*Frontal Lobe*, n.d.-d) The frontal lobe is the largest lobe accounting for **41%** of the total neocortical volume.(*Frontal Lobe*, n.d.-a)

The frontal lobe divides it into three areas, each having a specific brain function. (*Frontal Lobe*, n.d.-b) These are

- a. **The prefrontal cortex :** The prefrontal cortex corresponds to the superior, middle and inferior frontal gyri of the frontal lobe. It is associated with higher brain functions including decision-making, problem-solving, planning, organizing, motivation, discipline, and emotional regulation. (*Frontal Lobe*, n.d.-c; *Frontal Lobe*, n.d.-a)

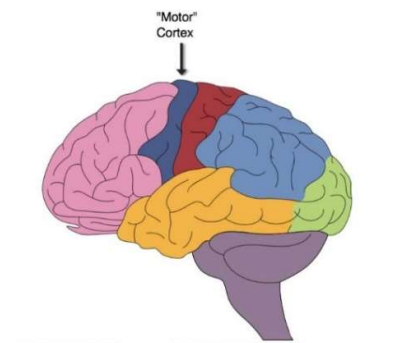
FIGURE 8



(Image Source: *Frontal Lobe* - Labster, n.d.)

- b. **The motor cortex:** The motor cortex corresponds to the precentral gyrus of the frontal lobe. It is responsible for planning, control, and execution of voluntary movements. It involves the primary motor cortex, supplementary motor cortex and premotor cortex. (*Frontal Lobe*, n.d.-c) It can be divided into two main regions: **the primary motor cortex**, which initiates movements, and the **nonprimary motor cortex**, which handles movement planning and selection. Each hemisphere controls muscles on the opposite side of the body. (*Motor Cortex*, 2025)

Figure 9



- c. **Broca's area (Figure 8):** It is mainly responsible for expressive motor speech, which involves verbal fluency, phonological processing, grammar processing and attention during speech. Although Broca's area is mainly associated with language production, it also plays a significant role in language comprehension. (*Frontal Lobe*, n.d.-c)
2. **The parietal lobe:** The parietal lobe is located on the side of the cerebral hemisphere, just behind the central sulcus, back to the frontal lobe. The parietal lobe is vital for sensory perception and integration, including the management of taste, hearing, sight, touch, and smell. It is home to the brain's primary somatic sensory cortex, a region where the brain interprets input from other areas of the body. (*Parietal Lobe*, n.d.)

handles higher level **symbolic processing**, which is essential for reading, writing, and performing mathematical calculations.

3. **The temporal lobe:**(the temple) just forward from the base of the brain , ventral to the frontal and parietal lobes

Key Functions of the Temporal Lobe

a. **Auditory Processing (Hearing)**

- The temporal lobe contains the **primary auditory cortex**, which receives and processes sound information from the ears.
- It helps in recognizing different sounds like speech, music, and environmental noises.

b. **Language Comprehension**

- The temporal lobe houses **Wernicke's area**, which is essential for understanding spoken and written language.
- Damage to this area can lead to difficulty in understanding language (Wernicke's aphasia).

c. **Memory Formation**

- Includes the **Hippocampus**, which is crucial for forming new long-term memories.
- Helps in learning and recalling information.

d. **Emotion and Behavior**

- Works with the **Amygdala** to regulate emotions like fear, anger, and pleasure.
- Plays a role in emotional memory.

e. **Object and Face Recognition**

- Helps identify objects and recognize faces (important for social interaction).

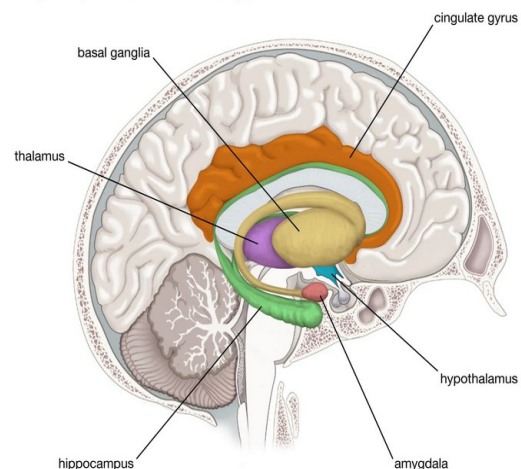
f. **Processing of Visual Information (Partly)**

- Works with other lobes to interpret complex visual stimuli, especially related to identifying “what” we see (ventral stream).

4. **The occipital lobe (Figure 6):** The occipital lobe lies at the very back of the brain, back to the parietal and temporal lobes. It contains the primary visual cortex (V1), which receives visual information from the eyes via the thalamus and It also processes visual information such as light, color, shape, and movement through the primary visual cortex. It also helps interpret what we see and works with other brain regions for object recognition and spatial awareness.

Limbic system: limbic system, group of structures in the brain that governs emotions, motivation, olfaction (sense of smell), and

Primary components of the limbic system



behaviour. The limbic system is also involved in the formation of long-term memory. The structures of the limbic system are found deep inside the brain, immediately below the temporal lobes and buried under the cerebral cortex, just above the brainstem.. The limbic system consists of several interconnected components, including the thalamus, hypothalamus, basal ganglia, cingulate gyrus, hippocampus, and amygdala. A dysfunctional limbic system is associated with several conditions and clinical disorders such as epilepsy, dementia, anxiety disorders, and autism. (*Britannica*, 2026)

Cingulate Gyrus: cingulate gyrus is a curved structure located on the medial surface of the brain, just above the corpus callosum, and is an important part of the limbic system. It plays a key role in regulating emotions such as fear and pleasure, as well as in cognitive functions like attention, decision-making, and error detection. The cingulate gyrus is also involved in processing the emotional aspect of pain and helps control motivation and goal-directed behavior. Additionally, it contributes to autonomic functions by influencing bodily responses like heart rate and blood pressure, especially during emotional experiences.

Amygdala: A components of limbic system Primarily responsible for emotional processing, particularly those tied to survival instincts like fear and aggression. (*Limbic System*, 2025)

Hippocampus: A components of limbic system Crucial for memory formation and the consolidation of short-term memory into long-term storage. (*Limbic System*, 2025)

Basal ganglia: The basal ganglia are a group of subcortical nuclei in the brain that play a crucial role in the control and coordination of voluntary movements. They help in initiating and regulating smooth, purposeful motor activity while inhibiting unwanted movements. In addition to motor control, the basal ganglia are involved in procedural learning, habit

formation, and the automation of routine behaviours. They also contribute to cognitive and emotional functions, such as decision-making, motivation, and reward processing. Dysfunction of the basal ganglia is associated with movement disorders like Parkinson's disease and Huntington's disease.

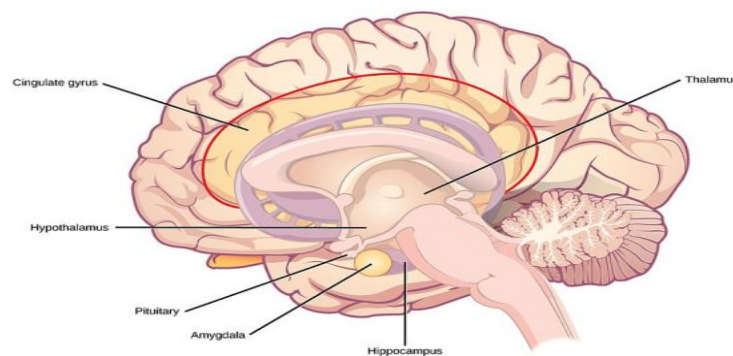
2. Diencephalon:

The **diencephalon** lies **between the cerebrum and midbrain**.

It mainly includes:

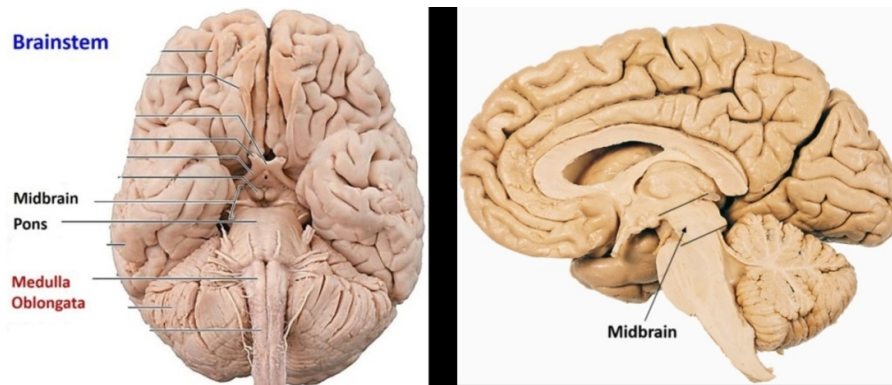
- **Thalamus** – Thalamus is a large mass of the gray matter. It forms the dorsal part of the diencephalon and is located between the cerebral cortex and the midbrain. It relays sensory information to the cerebrum.
- **Hypothalamus** –The hypothalamus is the region of the forebrain and is just below the thalamus. It connects to both lobes of the pituitary gland. Specifically, the hypothalamus connects the anterior pituitary gland by means of a portal blood system communicating through chemical signals, and thus, stimulating and inhibitory hormones. Meanwhile, it directly connects to the posterior pituitary through neurons. Thereby, the hypothalamus, basically, regulates the functions of the pituitary gland.(*Brain Fissure Diagram Sylvian Rolandolongitudinal Sulcus Stock Vector (Royalty Free) 2113294106*, n.d.). It controls body temperature, hunger, thirst, hormones, and maintains homeostasis.

Figure 10



(*Brain Fissure Diagram Sylvian Rolandolongitudinal Sulcus Stock Vector (Royalty Free) 2113294106*, n.d.)

Midbrain: (*Mesencephalon*)



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