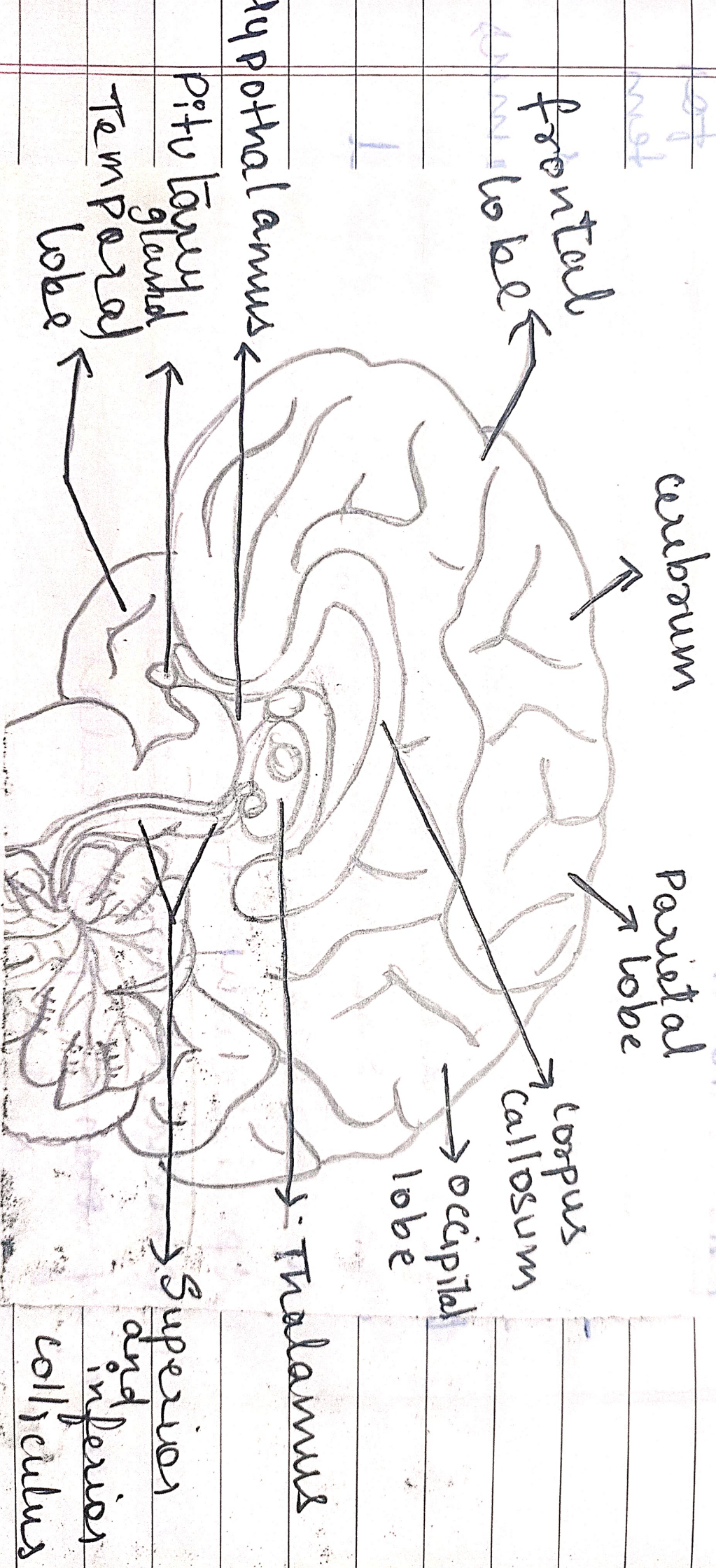


Forebrain (Prosencephalon)



The forebrain consist of 2 cerebral hemisphere, one on the left and one on the right. Each hemisphere is organised to receive sensory information, mostly from the opposite of the body. It controls muscles, mostly on the contralateral side (opposite), by way of axons to spinal cord and the cranial nerve.

The outer portion is the cerebral cortex. (Cerebrum is a latin word for "brain". Cortex is a latin word for "bark" or "shell".)

Under the cerebral cortex are other structures, including the thalamus and the basal ganglia. Several interlinked structures, known as limbic system, form a border (or limb, the latin word for "border") around the brainstem.

The limbic system includes the olfactory bulb, hypothalamus, hippocampus, amygdala and cingulate gyrus of the cerebral cortex.

(i) Diencephalon Thalamus

The thalamus and hypothalamus form the diencephalon, a section distinct from the telencephalon which is part of the forebrain. Thalamus is ^(Caracado) egg shaped ^{of hemisphere} structured & residing on either sides in the centre of the forebrain.

The term derives from a greek word meaning "anteroom", "inner chamber" or "bridged".

Most sensory information goes first to the thalamus, which processes it and sends output to the cerebral cortex. An exception to this rule is for olfactory information, which goes from olfactory receptors to the olfactory bulb and then directly to the cerebral cortex.

The thalamus can be divided into different regions of nuclei, all of which are described by their position.

These nuclei can themselves be subdivided into smaller nuclei. Many nuclei of the thalamus receive their input from a sensory system such as vision, and transmit

information to a single area of the cerebral cortex.

The cerebral cortex sends information back to the thalamus prolonging and magnifying certain kinds of input and focusing attention on particular stimuli.

Hypothalamus

The hypothalamus, a small area near the base of the brain just ventral to the thalamus, has widespread connections with the rest of the brain. "Hypo" means "less than" or "beneath". It is about 1 cubic centimetre in size but its functional importance is enormous. Hypothalamus along with other areas of brainstem are responsible for mediating or maintaining homeostatic, refers to the process whereby physiological variables such as temperature, fluid regulation and nutrient storage are maintained.

Hypothalamus conveys messages to pituitary, (partly through nerves and partly through releasing hormones) affecting its release of hormones.

Damage to any hypothalamus ^{nucleus} ~~conveys~~ ^{message} leads to abnormalities in motivated behaviours such as feeding, drinking, temperature regulation, sexual behaviour, fighting or activity level.

Pituitary Gland.

The pituitary gland is an endocrine (hormone producing) gland attached to the base of the hypothalamus.

In response to messages from hypothalamus, the pituitary synthesizes hormones that the blood carries to organs throughout the body. Hormones act in a similar way to neurotransmitters - they stimulate receptor molecules - but unlike neurotransmitters - their ~~stimulate~~ reach is wider.

Basal Ganglia.

Basal Ganglia, a group of subcortical structures lateral to the thalamus, includes three major structures: the caudate nucleus, the putamen and the globus pallidus. Caudate is the long tail-like structure, each caudate forms an almost complete circle, in its center, connected to it by a series

fibrous bands, is the putamen. Together, the caudate and the putamen, which both have a striped appearance, are known as the striatum.

The remaining structure of the basal ganglia is the pale circular structure known as the globus pallidus. It is located medial to the putamen between the putamen and the thalamus.

It has long been known that damage to the basal ganglia impairs movement, as in conditions such as Parkinson's and Huntington's disease.

The basal ganglia integrate motivational and emotional behaviour to increase the vigour of selected actions.

However, the role of the basal ganglia extends beyond movement.

They are critical for learned skills and habits as well as other type of learning that develop gradually with extended experience.

Basal Forebrain.

One of the structures on the ventral surface of the forebrain the nucleus basalis, receives input from the hypothalamus and basal ganglia and sends axons that release acetylcholine to widespread areas in the cerebral cortex.

The nucleus basalis is a key part of the brain's system for arousal, wakefulness and attention.

Patients with Parkinson's and Alzheimer's disease have impairment of attention and intellect because of inactivity or deterioration of their nucleus basalis.

Hippocampus.

The hippocampus (from a latin word meaning "seahorse", a shape suggested by the "hippocampus") is a large structure between the thalamus, the cerebral cortex mostly towards the posterior of the forebrain.

The gist of that discussion is that the hippocampus is critical for storing certain kind of memories. People with hippocampus damage have trouble in storing new memories, but they

not lose the memories they have before the damage occurred.

Ventricles

The nervous system begins its development as a tube surrounding a fluid canal.

The canal persists into adulthood as the central canal, a fluid-filled channel in the centre of the spinal cord, and as the ventricles, four fluid-filled cavities within the brain. Each hemisphere contains one of the two large lateral ventricles.

Towards their posterior, they connect to the third ventricle, positioned at the midline, separating the left thalamus from the right thalamus.

The third ventricle connects to the fourth ventricle in the centre of the medulla.

Cells called choroid plexus inside the four ventricles produce cerebrospinal fluid (CSF), a clear fluid similar to blood plasma.

CSF fills the ventricles, flowing from the lateral ventricles to the

third and fourth ventricles. From fourth ventricle, some of it flows into the central canal of the spinal cord, but more goes into the narrow spaces between the brain and the thin meninges, membranes that surround the brain and spinal cord.

In one of those narrow spaces, the ~~the~~ subarachnoid space, the blood gradually reabsorbs the CSF. Although the brain has no pain receptors, the meninges do, the meningitis — inflammation of the meninges — is very painful. A swelling of blood vessel in the meninges is also responsible for the pain of a migraine headache.

CSF cushions the brain against mechanical shock when the head moves. It also provides buoyancy. Just as a person ~~less~~ weighs less in water than on land, CSF helps support the weight of the brain. It also provides a reservoir of hormones and nutrition for the brain and the spinal cord.

Sometimes, the flow of CSF is obstructed, and it accumulates within the ventricles or in the subarachnoid space, increasing pressure.

on the brain. When this occurs in infants, the skull bones may spread, causing an overgrown head. This condition, known as hydrocephalus, is usually associated with mental retardation.

The cerebral cortex.

The most prominent part of the mammalian brain is the cerebral cortex. The cells on the outer surface of the cerebral cortex are gray matter, and their axons extending inward are white matter.

Neurons in each hemisphere communicate with neurons in the corresponding part of the other hemisphere through two bundles of axons ~~and~~ the corpus callosum and the smaller anterior commissure.

Several other commissures link subcortical structures.

The cerebral cortex constitutes a higher percentage of the brain in primates — monkeys, apes and human — than in other species.

of comparable sizes. The investigators arrange the insectivores and primates from left to right in terms of what percentage of their brain was devoted to the forebrain (telencephalon) which includes the cerebral cortex.

They also inserted tree shrews, a species often considered intermediate. Note that as the proportion devoted to the forebrain increases, the relative sizes of the midbrain and medulla decrease. Curiously, the cerebellum occupies a remarkably constant percentage - approximately 13% of any mammalian brain.

That is the cerebellum maintains an almost constant proportion to the whole brain.

Organisation of the cerebral cortex
In humans and most other mammals, the cerebral cortex contains up to six distinct laminae, layers of cell bodies that are parallel to the surface of the cortex and separated from each other by layers of fibres. The laminae vary in thickness and prominence from

one part of the cortex to another, and a given lamina may be absent from certain areas.

Lamina V which sends long axons to the spinal cord and other distant areas, is thickest in the motor cortex, which has the greatest control of the muscles.

Lamina IV which receives axons from the various sensory nuclei of the thalamus, is prominent in all the primary sensory areas (visual, auditory, and somatosensory) but - absent from the motor cortex.

The cells of the cortex are also organised into columns of cells perpendicular to the laminae.

The cells within a given column have similar properties to one another,

does. Researchers make several finer distinctions among areas of the cerebral cortex based on the structure and function of cells.

For convenience, we group these areas into 4 lobes named for the skull bones that lie over them: occipital, parietal, temporal and frontal.

Occipital lobe.

The occipital lobe, at the posterior (caudal) end of the cortex, is the main target for visual information.

The posterior pole of occipital lobe is also known as primary visual cortex or striate cortex because of its striped appearance in cross section.

Destruction of any part of the striate cortex causes cortical blindness in the related part of the visual field.

For example, extensive damage to the striate cortex of the right hemisphere causes blindness in the left visual field. A person with cortical blindness has normal eyes and pupillary reflexes but no conscious visual perception and no visual imagery. People who suffer eye damage become blind but if they have an intact occipital cortex and previous visual experience, they can still imagine visual scenes and can

still have visual dreams. In short, the eyes provide the stimulus, and the visual cortex provides the experience.

Parietal lobe.

The parietal lobe lies between the occipital lobe and the central sulcus, a deep groove in the surface of the cortex. The area just posterior to the central sulcus, the postcentral gyrus or primary somatosensory cortex, receives sensations from touch receptors, muscles - stretch receptors, and joint receptors.

Brain surgeons sometimes use only local anesthesia that is, anesthetizing the scalp but leaving the brain awake.

If during this process they lightly stimulate the postcentral gyrus, people report "tingling" sensations on the opposite side of the body. The postcentral gyrus includes 4 bands of cells parallel to the central sulcus. Separate areas along each band receive simultaneous information from

different parts of the body. It

Two of the bands receives mostly sight - touch information, one receives deep pressure information and one receives a combination of both. In effect, the post central gyrus represents the body four times.

Information about touch and body location is important not only for its own sake but also for interpreting visual and auditory information.

The parietal lobe monitors all the informations about eye, head and body positions and passes it on to brain areas that control movement.

It is essential not only for spatial information but also numerical information.

Temporal lobe:

The temporal lobe is the lateral portion of each hemisphere, near the temples. It is the primary cortical target for auditory information. The human temporal lobe - in most cases, the left temporal lobe - is essential for understanding spoken language.

The temporal lobe also contributes to complex aspects of vision, including perception of movement and recognition of faces. A tumor in the temporal lobe may give rise to elaborate auditory or visual hallucinations, whereas a tumor in the occipital lobe ordinarily evokes only simple sensations, such as flashes of light. When psychiatric patients reports hallucinations, brain scans detect much activities in the temporal lobe.

The temporal lobes are also important for emotional and motivational behaviours. Temporal lobe damage can lead to a set of behaviours known as the Klüver-Bucy syndrome. They put almost anything they find into their mouths and attempt to pick up snakes and lighted matches. Interpreting this behaviour is difficult.

Frontal lobe

The frontal lobe, which contains the primary motor cortex and the prefrontal cortex - extend

from the central sulcus to the anterior limit of the brain. The posterior portion of the frontal lobe just anterior to the central sulcus, the precentral gyrus, is specialized for the control of fine movement, such as moving one finger at a time. Separate areas are responsible for different parts of the body mostly on the contralateral (opposite) side but also with slight control of the ipsilateral (same) side.

For example, within the arm area there is no one-to-one relationship between brain location and specific muscles. The most anterior portion of the frontal lobe is the prefrontal cortex. In general, the larger a species cerebral cortex, the higher the percentage of it is devoted to the prefrontal cortex.

For example, it forms a larger portion of the cortex in humans and all the great apes than in other species.

It is primary target for any sensory system, but it receives information from all of them in different parts of the

prefrontal cortex. The dendrites in the prefrontal cortex have up to 16 times as many dendritic spines as neurons in other cortical areas. As a result, the prefrontal cortex integrates an enormous amount of information.

Prefrontal Cortex

Recent research including people and monkeys with brain damage found that the prefrontal cortex is important for working memory, the ability to remember recent stimuli and events, such as where you parked the car today or what you were talking about before being interrupted.

The prefrontal cortex is especially important for the delayed-response task in which a stimulus appears briefly, and the individual must respond to the remembered stimulus briefly after a brief

delay. Neuroscientists have offered several other hypotheses about the function of the prefrontal cortex. One is that it is

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essentially general behaviours that depends
without the context. Damage results
in blunted emotional responses,
aggression and poor task manage-
ment etc.