



ANATOMY

DONE BY : Osama Kamal

DIENCEPHALON

** The diencephalon includes everything with the name thalamus i.e. Thalamus, hypothalamus, epithalamus, metathalamus & subthalamus.

** Its cavity is the 3rd ventricle.

** It is divided by the hypothalamic sulcus (which extends from the interventricular foramen to the mouth of the cerebral aqueduct) into:

A. Dorsal part: 1. Thalamus. 2. Metathalamus (MGB & LGB). 3. Epithalamus (pineal body, habenular nuclei & posterior commissure).

B. Ventral part: 1. Hypothalamus. 2. Subthalamus.

THALAMUS

** It is an oval mass of grey matter which acts as a gateway for the cerebral cortex.

** It relays all sensations except smell. It also relays motor and limbic impulses going to the cerebral cortex.

** It has 2 ends:

1. A narrow anterior end which lies posterior to interventricular foramen of Monro.

2. Its posterior end is expanded to form the **pulvinar**.

** It has 4 surfaces:

1. Superior surface → is free. It is related to the choroid plexus and forms part of the floor of the body of lateral ventricle.	2. Inferior surface → is separated by hypothalamic sulcus from subthalamus & hypothalamus. The posterior part of this surface shows the medial & lateral geniculate bodies.	3. Medial surface → Forms the lateral wall of 3rd ventricle. Both medial surfaces are connected together by the interthalamic adhesion (connexus).	4. Lateral surface → separated from the lentiform nucleus by the internal capsule.
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Thalamic nuclei:

** The grey matter of thalamus is divided by a Yshaped sheet of white matter (internal medullary lamina) into:

I. Anterior nuclei:	II. Medial nuclei (Dorsomedial nucleus):	III. Lateral part of thalamus:	
<p>* Site: between the 2 limbs of the Y-shaped internal medullary lamina.</p> <p>* Afferents: receives the mammillo-thalamic tract from the mammillary bodies.</p> <p>* Efferents: sends the anterior thalamic radiation to the cingulate gyrus.</p> <p>* Function: forms part of the limbic system (Papez circuit) which is concerned with emotions and recent memory.</p>	<p>*Afferents: from the hypothalamus, amygdala & olfactory cortex</p> <p>* Efferents: via the medial forebrain bundle to the prefrontal cortex.</p> <p>* Function: forms part of the limbic system involved in thinking & mood.</p>	A. Dorsal tier:	B. Ventral tier: 3 nuclei:
		<p>* Includes 3 association nuclei: Lateral-dorsal nucleus, Lateral-posterior nucleus & Pulvinar.</p> <p>* Afferents: they receive input from the other thalamic nuclei and integrate them; the thalamus is considered as a multisensory processing unit.</p> <p>* Efferents: to the sensory association areas of the cortex.</p>	1. Ventral-anterior (VA) nucleus:
			<p>* Afferents: from the basal ganglia (globus pallidus).</p> <p>* Efferents: to the supplementary motor area.</p> <p>* Function: relays motor circuits.</p>
			2. Ventral-lateral or ventral-intermediate (VL or VI) nucleus:
		<p>*Afferents: from the cerebellar nuclei. * Efferents: to the motor and premotor areas.</p> <p>* Function: relays motor planning of voluntary movement.</p>	
3. Ventral-posterior nucleus (VP nucleus): is sensory & includes 2 parts:	<p>a. VP Lateral (VPL):</p> <p>* Afferents: receives the medial & spinal lemnisci.</p> <p>* Efferents: to the upper 2/3 (body area) of the postcentral gyrus.</p>	<p>b. VP Medial (VPM):</p> <p>* Afferents: receives the trigeminal lemniscus & solitariothalamic tract (carrying taste).</p> <p>* Efferents: to the lower 1/3 (head area) of the postcentral gyrus.</p>	

**** Other thalamic nuclei:**

Medial & lateral geniculate bodies: (both are called metathalamus):		3 Non-specific nuclei which occupy strategic positions in the thalamus:		
1. The medial geniculate body (MGB):	2. The lateral geniculate body (LGB):	1. Intralaminar nuclei: (within the internal medullary lamina).	2. Midline nuclei: (on the medial surface of thalamus beneath the ependyma of 3rd ventricle):	3. Reticular nucleus:
<p>* Afferents: receives auditory input from the inferior colliculus of midbrain.</p> <p>* Efferents: projects auditory radiation to the auditory area of cortex.</p>	<p>* Receives: visual input from the optic tract.</p> <p>* Projects: optic radiation to the visual area of cortex.</p>		<p>* Afferents: from the reticular formation of the brain stem.</p> <p>* Efferents: to the whole cortex non-specifically; increases its activity.</p> <p>* Functions: part of RAS responsible for alertness.</p>	<p>* Site: on the lateral surface of the thalamus.</p> <p>* Afferents: from whole cerebral cortex.</p> <p>* Efferents: do not leave the thalamus but end on the thalamic nuclei.</p> <p>* Functions: inhibits the thalamic nuclei during sleep.</p>

**** Blood Supply:**

A. Arterial:

* **Medial & anterior regions:** by posteromedial group of posterior cerebral artery.

* **Lateral & posterior parts:** by posterolateral group of posterior cerebral artery (thalamogeniculate artery).

B. Venous drainage: thalamo-striate vein.

**** Applied: Thalamic syndrome:**

* **Vascular lesions of the thalamus (thalamogeniculate artery) → decreased threshold to pain with overreaction to painful stimuli & spontaneous pains.**

HYPOTHALAMUS

- **Site & extent:** * It lies below the thalamus separated from it by the hypothalamic sulcus.

* Anteriorly: it extends till the lamina terminalis	* Posteriorly: it extends till a vertical plane posterior to mammillary bodies	* Superiorly: it extends till the hypothalamic sulcus.	* Inferiorly: it forms the base of the brain beneath the 3rd ventricle (the floor of the interpeduncular fossa).
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- **Parts:** 1. Optic chiasma. 2. Tuber cinereum (median eminence) & infundibular stalk. 3. Mammillary bodies.
- **Nuclei:** The hypothalamus contains many nuclei related to the above mentioned parts such as: suprachiasmatic N., supraoptic N., tuberal N., infundibular N., paraventricular N., mammillary nuclei, etc.)
- **Functions:**
 1. It controls the autonomic nervous system and endocrine system (pituitary).
 2. It regulates fluid intake, food ingestion and body temperature.
 3. It controls emotions, reproduction and biological clock.
- **Connections:**

1. With the prefrontal cortex: the periventricular system of fibers connects it (both-ways) with the dorsomedial nucleus of thalamus.	2. With the limbic system:	3. With lower centers:	4. With pituitary gland:		
			A. Hypothalamo-hypophyseal tracts:	B. Infundibular (Arcuate) N.:	
			a. Supraoptic-hypophyseal: Supraoptic N. secretes vasopressin which passes through axons to posterior pituitary where they are absorbed by blood capillaries.	b. Paraventricular-hypophyseal: Paraventricular N. secretes oxytocin which passes through axons to posterior pituitary where they are absorbed by blood capillaries.	secretes the release- and release-inhibiting hormones taken by blood capillaries in the superior set of capillaries → (portal veins) → inferior set of capillaries in anterior pituitary where hormones pass to specific cells in the anterior pituitary

SUBTHALAMUS

- ** Site:** it is inferior to thalamus, separated from it by the hypothalamic sulcus. It lies between thalamus and tegmentum of mid brain.
- ** It contains:** subthalamic nucleus which is closely related to the basal ganglia (involved in control of muscular activity).
- ** Its lesion** → Hemiballismus (severe violent involuntary movement on one side of the body).

EPITHALAMUS

A. Pineal body:	B. Habenular nuclei:	C. Posterior commissure:
<p>* It is a small reddish grey organ, 8 mm in length which hangs between the two superior colliculi. It lies inferior to the splenium of corpus callosum. Its base (stalk) is directed anteriorly and forms two laminae; a superior and an inferior laminae.</p> <p>* The superior lamina contains habenular commissure while the inferior lamina contains the posterior commissure. The space between the two laminae of the stalk is a recess (pineal recess) of the 3rd ventricle.</p> <p>* Function: It is an endocrine gland that inhibits the pituitary gland, pancreas, parathyroids, adrenal cortex and gonads. It is active in the dark secreting melatonin hormone by its pinealocytes.</p> <p>* After puberty, it becomes calcified forming the brain sand which is a landmark in skull x-rays.</p>	<p>* The habenular nuclei lie in the habenular trigone, anterosuperior to the superior colliculus.</p> <p>* The right and left nuclei are connected together by the habenular commissure which passes through the superior lamina of pineal stalk.</p>	<p>* This traverses the inferior lamina of pineal stalk.</p> <p>* Function: it connects</p> <ol style="list-style-type: none"> 1. The superior colliculi of both sides. 2. The medial longitudinal bundles of both sides. 3. The pretectal nuclei of both sides.

THIRD VENTRICLE

** It is the cavity of the Diencephalon.

** Communications:	** Boundaries:	** Recesses of third ventricle:
<p>1. With the lateral ventricles via the interventricular foramen of Monro.</p> <p>2. With the fourth ventricle via the cerebral aqueduct of Sylvius.</p>	<p>1. Lateral Wall: Thalamus and hypothalamus.</p> <p>2. Roof: Layer of ependyma covered by the tela choroidea of the third ventricle. Choroid plexus of third ventricle hangs from its roof as two longitudinal elevations.</p> <p>3. Floor: Formed mostly of hypothalamic structures (optic chiasma, infundibulum, tuber cinereum, mammillary bodies), posterior perforated substance + tegmentum of midbrain.</p> <p>4. Anterior Wall: Lamina terminalis, column of fornix, anterior commissure.</p> <p>5. Posterior Wall: Posterior commissure, pineal body, suprapineal recess.</p>	<p>1. Optic recess: above optic chiasma.</p> <p>2. Infundibular recess: extends into pituitary stalk.</p> <p>3. Pineal recess: extends between laminae of stalk of pineal gland.</p> <p>4. Suprapineal recess: extends above pineal gland.</p>